Impact of Covid-19 on urban mobility in the city of Liege

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IMPACT OF COVID-19 ON URBAN MOBILITY IN THE CITY OF LIEGE

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List of abbreviations / Glossary

CO2 = Carbon dioxide

GHG: GreenHouse Gas emissions

MaaS: Mobility as a Service

NGO: Non Governemental Organization

SPW: Service Public of Wallonia

SRAS : Respiratory Ailment Severe Syndrome

PCM : Plan Communal de Mobilité

PUM : Plan Urbain de Mobilité

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Introduction

According to a statement made by the World Health Organization (OMS) on January 30, 2020, the COVID-19 epidemic was a global health emergency. Less than two months later, on March 11, 2020, the OMS announced that the epidemic had turned into a global pandemic and that the COVID-19 virus was highly contagious among humans. As a result, preventative measures were put in place; some countries were totally cut off, and practically all businesses were shut down. Due to its rapid rate of spread, danger, and ease of transfer from one person to another, this virus has already damaged the most effective health care systems in developed countries.

The COVID-19 crisis is a generic event, meaning it has a low probability but a definite impact that seems to be overlooked in the decision-making process (Mendonça et al., 2004). However, the heavy use of public transportation fosters an environment that is conducive to the spread of infectious diseases, posing a serious risk to the city's overall health. Numerous measures have been proposed or put into effect by the nations to stop the spread of COVID-19, and these regulations have had a significant impact on how people travel. The observation of the users' changing modes of transportation has been one of the most significant effects since movements are a crucial part of daily household organization and frequently reflect the need to balance time and space.

The idea of urban mobility has been discussed in literature, and it's critical to understand the structural factors that influence mobility. One of the most significant factors identified is the variety of goods or services offered, whether they are delivered by private vehicles or by public transportation. (Farahani et al. 2013). Additional factors include the cost of the trip (McFadden, 1974), the household income of those who must move (Schafer and Victor, 2000), the mode of transportation and how it integrates with the environment (Giuliano and Dargay, 2006), the time and distance of the trip, as well as the characteristics of the user and their economic status (Baudelle et al., 2004). Naturally, choosing a means of transportation to get to a certain location differs greatly from a longer or shorter commute from home. Therefore, leaving one's home, traveling to and from the places of activity, and taking part in activities can all be viewed as parts of urban population mobility.

It has also been observed that numerous enterprises have closed and transportation habits have changed, causing a sharp decline in the amount of greenhouse gas emissions (GES), which has improved the quality of the air (Venter et al., 2020). The obvious effects of the crisis on global energy demand and CO2 emissions would promote its continuation, popularizing or at the very least democratizing any regulated urban transportation methods that have been or are already in use. If one wants to achieve carbon neutrality by the year 2050, changes in individual behavior as well as group organization must be made.

Our study's goals are to show the disruptive effects infectious diseases, in particular the COVID-19, can have on urban mobility by focusing on home-to-work travel, and to show how these effects might be used to support more environmentally friendly transportation systems. In order to draw attention to potential changes, the following research questions must be addressed:

- **What impact has the COVID-19 pandemic had on users' ability to move across cities?**
- **How do users perceive the implementation of new forms of urban mobility?**
- **What lessons from COVID-19 can we use to lessen the effect of a public health crisis on urban mobility?**

To help the reader better understand the fundamental concepts implied, this essay will first provide some general information on urban mobility in order to get into further detail on the numerous research concerns. As a result, the first chapter will provide us an overview of urban mobility in general and a description of mobility initiatives in the city of Liège before concluding with an overview of the pandemics that have affected Europe. The second chapter will summarize the key ideas discovered throughout our documentary research while outlining the potential impacts that a pandemic like the Covid-19 might have on urban mobility. The study's methodology is described in Chapter 3 along with a framework for conducting an investigation. In the fourth chapter, we provide some responses to the topic of how the Covid-19 pandemic has affected residents of the city of Liège's urban mobility habits with regard to commuting travels. These results will then be the topic of a discussion that will result in recommendations. This investigation will ultimately come to a conclusion.

Chapitre 1: Context

Since a few decades ago, new lifestyles and mobility practices have emerged. For a variety of reasons, people are moving around more and more, and doing so by using more and more transportation options. Thus, everyone is aware that mobility issues represent more significant economic, technological, and sociopolitical issues in a society where all types of transportation and flow are developing. It is important to think of mobility as a resultant of lifestyle choices in order for it to fulfill its function to the fullest extent possible. Complex in nature, mobility is marked by ongoing change in line with societal changes.

The daily activities of the average person, commercial competition, and economic growth all revolve around transportation. As a result, transportation is a manufacturing activity that, by itself, assembles all of the space's individual components and directly promotes its development. This includes, among other things, human resources, infrastructures, vehicles, and utilization techniques

1. Definition

1.1 Urban mobility

Despite the fact that the terms "transport" and "mobility" are sometimes used synonymously to refer to the same thing, a certain type of movement, Piron (2000) asserts that mobility differs from transportation in that it allows for social connection and communication. By reference to its physical and technological supports, particularly the infrastructure and transportation systems, it is a means of exchange, meeting, and contact of all kinds. As he points out, this definition encompasses a wide range of concepts, including and raises concerns about social, economic, and personal life processes as well as environmental and urban planning concerns.

According to another author, Tim Cresswell, while discussing mobility in a given space, it is important to consider not just the physical movement from point A to point B but also the implications that this movement has for the social context in which it takes place. Therefore, its definition is related to the social environment in which mobility exists (Cresswell, 2006). For him, the concept of "mobility" refers to a social and ideological aspect of that, and it is associated with concepts such as freedom, experimentation, creativity, and life itself.

The term "urban mobility," which is used by scientists and urbanists, can be seen as a cross-disciplinary field because it refers to transportation as well as many terms derived from urban morphology, including "urban space and landscape," "urban infrastructures," "urban fabric," and "urbanism," according to Kanter and Litow (2009). Different names have been assigned to the idea of urban mobility, or at least to related ideas. According to Kayal et al. (2014), urban mobility is defined as a system that effectively addresses the need for transportation and land use including geography and infrastructures, while also taking into account the sustainability dimension by incorporating the economic viability, environmental stability, and social equity of both present-day and future generations. So an urban user has the option to plan their mobility as they understand it, and they have access to a variety of tools to carry out their travel in line with their lifestyle.

1.1.1 Urban mobility components

The physical and spatial vision of urban mobility includes the roads, rails, cars, and trains, as well as the information and communication technology required to make them operate effectively. Additionally, organizations and individuals are required to oversee, manage, and ensure the planning, regulation, and tagging of transportation (Stead, 2013). The authors Auvinen and Tuominen (2014) assert that a variety of technological, social, economic, political, legal, and environmental factors must be taken into consideration in order to understand the complexity of urban mobility. They define the urban mobility system as consisting of four fundamental components: the infrastructure, vehicles, users, and governance. They suggested that a framework with three levels be used to explore the transition processes in the transportation system (figure 1):

- The level A with the landscape

The users are the key actors in mobility since they decide how to move around and how these many modes of transportation are organized, hence level A is the environment with users.

- The level B: Transportation system consists of

• Transportation infrastructure: The use of one mode of transportation over another obviously depends on the modifications made to support that mode. This is what we think of when we talk about infrastructure. The currently implemented global infrastructure determines the user's preferred mode of transportation.

• The structure of the transportation system: in order for interactions to be harmonious, there must be some coordination between the components that make up the system.

• The governance and regulations: A more integrated transportation policy must be promoted between various agencies or sectors involved in policy development, between levels of government, between geographically adjacent agencies, between policies with different time horizons and/or implementation dates, and between various systems and operators (Stead, 2016).

- The Level C: Technologies and solutions include transportation vehicles and methods.

Referring to the many methods of transportation and in accordance with Maskit (2018), we find the individual modes, which are made up of the car, the bicycle, and walking. This category is not homogeneous because the last two components fall under a different category called "soft mobility" (Woloszyn et al., 2010), where moving is the result of a decision and personal resources. Additionally, we have Segways, scooters, and other low-speed modes of transportation.

Then come collective modes; the purpose of collective transportation is to provide public transportation in certain areas of a community. They are referred to as " public transportation " since anybody can use the systems as long as they pay a fee and are usually detained and operated by a government agency. What we might run into in this category is:

• Low-speed transportation options include buses and trams.

• Fasts transportation, like as trains and metros

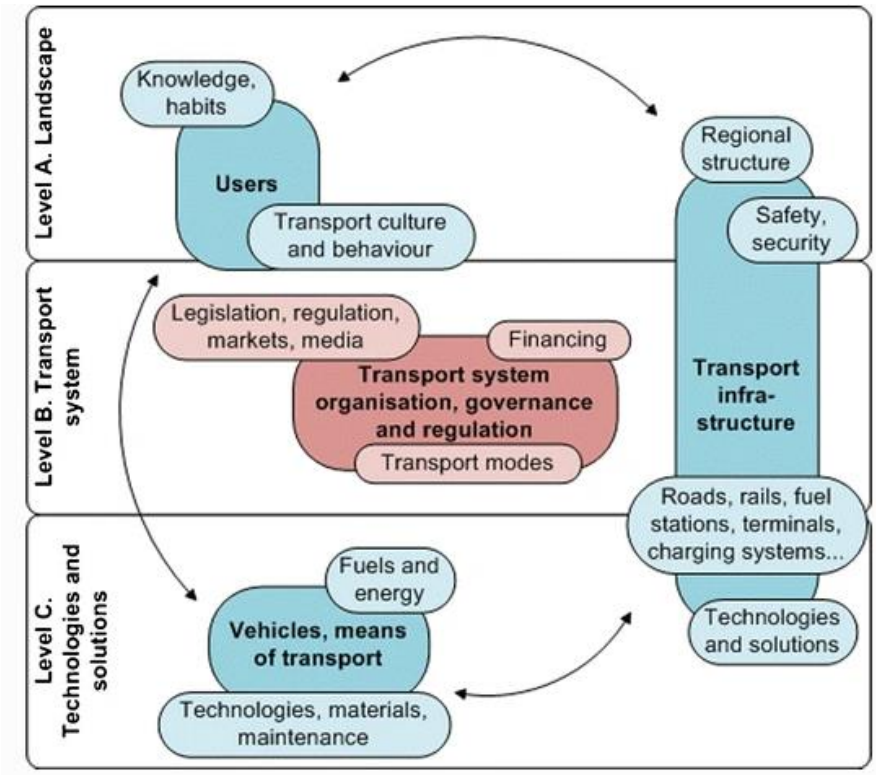

Figure 1: The three-level framework to study the transport system (Auvinen & Tuominen, 2014)

The position of each component in the figure indicates the level or levels where the activities are carried out, along with some crucial elements that are relevant for each component of the transportation system to indicate their primary level of application.

2- Strategic mobility tools in Liege

Since 1990, Liege has added more than 13,000 residents, and its current population is 200,000 (Leblanc, 2019). Liège is also home to 100,000 jobs and 100,000 students, which indicates significant mobility for the Wallonian region's economic hub. With time, mobility has grown to be an increasingly important factor in this changing and expanding city. Several factors come into play when it comes to the local tools that restrict mobility. In fact, even if they are optional and have an indicative value, they represent the authorities' ideals for how they want their territory to develop. The act that founded these plans is the First April 2004 Mobility and Local Accessibility Decree. These plans are crucial for understanding mobility policy since they establish the goals and guiding principles for future local mobility.

2.1 The Plan Communal de Mobilité

A new dynamic that is resolutely focused on the future has been implemented in the local government. Adoption of the Plan Communal de Mobilité (PCM), a non-technical document that was presented and discussed over numerous neighborhood community meetings, in 2004 marked the beginning of this new approach. which highlights the need for "a more thorough development and research of some modes of transportation (two-wheelers, pedestrians)" as well as the integration of new facets of urban mobility problems like road, safety, the environment (Ville de Liège, 2004).

There are mobility goals that are very clearly stated in the PCM: "The General Mobility Objectives of the City" are to provide on the territory:

o The quality of life: It's important to be able to give most streets a public space that is welcoming to everyone in order to address the phenomenon of desurbanization and restore a high standard of living along particular axes;

o The attraction: by revitalizing these numerous urban centers and properly incorporating future urban development projects into their surroundings, the city will strengthen its position as a major commercial, economic, and cultural hub.

o Accessibility: by encouraging good, secure, multimodal access for all types of users. The city's guiding principle should be complementarity. It is crucial to promote this method of transportation and to be prepared to suggest necessary alternatives to the car.

Any other mode must be able to emerge and be given preference on the public highway. In general, public transportation, two-wheeled vehicles, and foot travel will be given preference over cars. The city must also "attack the behaviors and the demand for mobility as well as the learning of other modes more respectful of our quality of life" in parallel to this approach of a "durable mobility policy," which focuses both on the infrastructure and the availability of mobility (Ville de Liège, 2004).

2.2 The Plan Urban de Mobilité

The Service Public of Wallonia (SPW) started developing the Plan Urbain de Mobilité (PUM) of the Liege Arrondissement in 2008 in response to local stakeholders' requests and in accordance with the 2004 ruling. Therefore, the PUM is a document that provides guidance on how to organize and manage general transportation, stationing, and accessibility at the scale of an urban agglomeration (Mobilité, 2018). The only project PUM Liege 2008 to have been published to date in Wallonia has two crucial characteristics:

- The first is to present a cohesive vision of the metropolis that values each location's uniqueness and complementarities by basing this on an analysis of the territorial dynamics and starting with the identification of potential development areas known as issue zones.

- The second is to suggest creating a network of structured transports that are embedded in a comprehensive and coherent multimodal idea. Additionally, it is an issue of whether or not micro-mobility and shared mobility can be developed. The term "micro-mobility" refers to light, portable, individual transportation devices that enable users to travel short or average distances (SPW, 2019). These practical means of propulsion are frequently used in addition to other forms of transportation. They enable a city's existing multimodal offering to be completed. These are either motorized or non-motorized conveyances that cannot go faster than 25 km/h.

The PUM 2008 project enabled a shared and ambitious vision of local governance to emerge in partnership with local actors. Consequently, even if it wasn't formally adopted, it appears to have clearly carried out the strategic role outlined in the decree of April 1, 2004 (Pluris et al., 2017). In terms of mobility, the PUM will put forth a multimodal transportation model that connects one form of transportation to the others. The core concept of the reflections is intermodality.

The Plan Urbain de Mobilité (PUM) will be adopted by the region of Liege, which is made up of its 24 municipalities, in 2019. This will allow each municipality to participate in a broader mobility vision and adapt its Community Mobility Plan to incorporate continuity.

According to a decision made by the Wallonian government on April 1, 2004, the Plan Urbain de Mobilité (PUM) aims to organize access to places of residence and employment from the perspective

of long-term development. In this regard, the PUM is a vital component of relational development. It identified potential economic conflict areas, proposed long-term geographic coherence, and developed a shared, ambitious, and utopian vision of the federation. And most importantly, it has become clear that without a comprehensive mobility plan and new tools, whether they are related to individual or group travel, we will face a regional travel asphyxiation in the near future and, as a result, a redirected development.

3. Reactions to previous pandemics

The historical responses to infectious disease outbreaks have the potential to inform and guide current attempts to control the spread of other infectious diseases as well as actions taken during similar outbreaks in the future. The SARS outbreak in 2003 in East Asia and the pandemic of the H1N1 virus in 2009 show how habits and procedures have changed among regular people as well as with transportation companies and government agencies to better protect one another from viruses. These epidemics have been a key turning point in our understanding of viral respiratory diseases and how they may pose a risk to public transportation systems.

3.1 Respiratory Ailment Severe Syndrome (SRAS), 2003

In China's Guangdong province in the latter half of 2002, a new coronavirus emerged that was initially recognized as an unusual respiratory illness before being named the severe respiratory illness syndrome, or SRAS (OMS, 2003). Similar to COVID-19, the SRAS is primarily transmitted by droplets and exhibits respiratory symptoms such coughing, wheezing, and breathing difficulties (OMS, 2020). The virus, by the end, had spread to 29 different countries, infecting 8096 people, and killed 774 people (CDC, 2016). With the possibility of an unknown, severe respiratory disease spreading through close contact with other diseases, public transportation systems were put to the test as the epidemic spread. According to Wang (2014), there is a correlation between the rise in cases, the perception of the virus, and an innate fear of infection.

In a 2005 survey by Sadique et al. (2007), people from five European countries and three Asian regions affected by the SRAS were asked about their behavior in relation to a perceived pandemic threat. They found that more than 54% of respondents in six of the eight regions named public transportation as the environment that was the most dangerous, with total avoidance of shared transportation being the most common form. Additionally, during the SRAS, the public's perception of the risk of infection has a significant impact on the demand for travel in public transportation, and providers of transportation services may experience a significant loss in financial revenue as a result of these precautionary measures (Sadique et al., 2007). In the early stages of the epidemic, bicycle sales in Pekin increased significantly and quickly, reaching nearly four times the average sales of a merchant (Buckley C, 2022). At the same time, the Chinese vehicle industry has seen sales rise more with the epidemic, partly due to the SRAS epidemic (Zhao, 2004). This indicates a transition because, especially in Chinese cities, people are switching from shared public transportation to more solitary modes of transportation like bicycles and cars.

3.2 Influenza A (H1N1), 2009

In 2009, a new strain of the influenza A virus known as the H1N1 influenza appeared in North America, with the first cases coming from the United States (CDC, 2009). Similar to SRAS, this epidemic presents challenges for the transportation industry in managing virus spread and the closed environment inherent in public transportation. The grippe is typically known to spread by droplets. In the United States, public transportation agencies are frequently ill-equipped to handle public health emergencies, where they will respond in a reactive manner in accordance with the recommendations of the Centers for Disease Control (CDC) (Faass et al., 2011). When the virus first broke out in the UK, the National Health Service (NHS) urged people to practice good personal hygiene, but the NHS has never run a campaign on how effectively avoiding public transportation might slow the spread of the disease (Rubin et al. 2009). Another survey by Jones and Salathé (2009) revealed that its respondents, mostly Americans, had indicated changes in behavior with regard to proactive preventive measures like frequent hand washing, avoiding public spaces and travel through affected areas, and avoiding those who appeared to be infected. These results are also a result of a relationship between perceived risk and anxiety related to contracting the virus, as people's behavior has changed as a result (Jones & Salathé, 2009). Mexico, however, responded differently to the outbreak of the pandemic than other cities did. Similar to how governments throughout the world responded to COVID-19, Mexican authorities effectively placed the city and the surrounding state in lockdown, closing schools and other leisure facilities to enforce social segregation (Wilkinson & Maugh II, 2009).

Chapitre 2: Litterature review

Due to the exploratory nature of the impact study, the information gathered from scientific and commercial materials and other sources also includes speculations and opinions about the potential effects of Covid-19 on urban mobility in a large city like Liege. It's also important to keep in mind that impacts typically don't occur in isolation from one another; rather, they are linked to one another, with one effect frequently causing another.

This chapter's goal is to compile the findings from a review of related literature. To effectively capture the breadth of this research effort, this literature review was organized around a key theme, impact of a pandemic and urban mobility. Thus, this third chapter offers a variety of viewpoints on the effect of an infectious disease on urban mobility while focusing specifically on the Covid-19 case.

3.1. Potential effects of an infectious disease on a city's mobility

Different nations and affected areas have responded to the epidemics in different ways with regard to travel and mobility. The potential effects of COVID-19 on our modes of transportation and transportation systems have been called into question, which has sparked a significant amount of discussion and thought on the subject. While some believe that the coronavirus crisis would undoubtedly lead to distinct changes in how people perceive and use urban transportation systems, more cautious people believe that this will require a lot of work on the side of planning systems.

3.1.1. Risk perception

The first and most significant effect of COVID-19 on the transportation industry is the negative perception of public transportation due to the perceived increase in the likelihood of contracting the disease there. According to Harikumar (2020), the public transportation sector has already been impacted by the end of February 2020, or before the COVID-19 was formally declared the world epidemic by the OMS. Recent studies have shown that there are lower risks of infection in public transportation when mask, ventilation, and decontamination are provided, and contact is brief, but transportation authorities are still dealing with what the International Association of Public Transportation has dubbed a "unjustified stigmatization of public transportation" (UITP, 2020). The most significant effect on societal mobility during the SRAS epidemic was already recognized to be the feeling of risk or fear of contracting the virus (Wilder-Smith et al., 2020). People's behavior was altered by their perception of a high risk of contracting a virus as a result of warnings to stay away from close contact zones, which could prompt them to avoid using public transportation (Wang, 2014).

Like the bicycle, the car gained ground during the coronavirus crisis, in part because of the perception that the risk of infection is lower than in some other modes. According to an SPF "Mobility and Transports" (2020) survey, the percentage of respondents who drive to work or school has increased from 56% before the lockdown to 65% while lockdowns. Personal contact, which is prevalent in citadins' mobility, is one of the most crucial features of infection. In fact, according to Marcucci et al.,(2020), the pandemic crisis has had a particularly negative impact on urban transportation systems, in addition to international travel.

Users of shared transportation are more likely to perceive risks when they use them, as noted by Neuburger and Egger (2020), during pandemics. Accordingly, risk perception could be described as a

subjective assessment of the risk of a potentially dangerous situation based on the situation's characteristics and importance. Anyhow, according to authors Martin, Richert and Schrader (2020) shared and public transportation will have the highest perceived risk profiles out of all modes. But higher-quality versions of these modes might help shift people's mindsets and encourage continued use. Measures include physical separation, the use of face masks, personal hygiene, decontamination, and ventilation are examined (Tirachini & Cats, 2020)

The closure of offices, schools, and other facilities has been mandated globally in response to COVID-19. According to a study on the COVID-19's effects, lower rates of infection and mortality are linked to higher levels of social isolation and fewer movements, particularly by public transportation (Mahmoudi et al., 2021). So social isolation may also help to slow the spread of the virus, delay its onset, and reduce its size, which may lessen the damage it causes to the body's immune system.

However, some authors, like De Vos (2020), are concerned that people are turning to other options because public transportation may be perceived as a place where it is difficult to avoid social contacts. People who have no other options may try to avoid the traffic during peak hours, but if public transportation operators decide to reduce capacity or frequency due to a lack of trips, that could make the problem more challenging. People who have access to a car may be more capable of driving because it "protects" them from other travelers.

The strong user perception of risk has also resulted in a significant decline in demand for public transportation. According to Candido et al. (2020), the mobility between and within states was a key factor in the regional and local spread of the virus. As a result, national transportation has been restricted. The majority of business trips and in-person activities have been replaced by teleconferences and other digital communication methods. According to a national labor force survey, 35.9% of the surveyed workers did some of their job from home in the second quarter of 2020. Additionally, due to the COVID-19 problem, 41.1% of teleworkers began doing so for the first time, they had never done so before (Statbel, 2020). Figure 2 below, taken from Corpus-Mendoza et al., (2020), shows how mobility has changed across continents since the Pandemic's inception. The vertical lines show when the majority of the countries in this region implemented their first measures. As seen in the chart, we can see that starting in March 2020, the demand for mobility is significantly lower than the scenario used to represent the need for mobility before to the pandemic. We can infer from this that as more people chose to work permanently from home, fewer people would need to travel, leading to a long-term decrease in the number of travels.

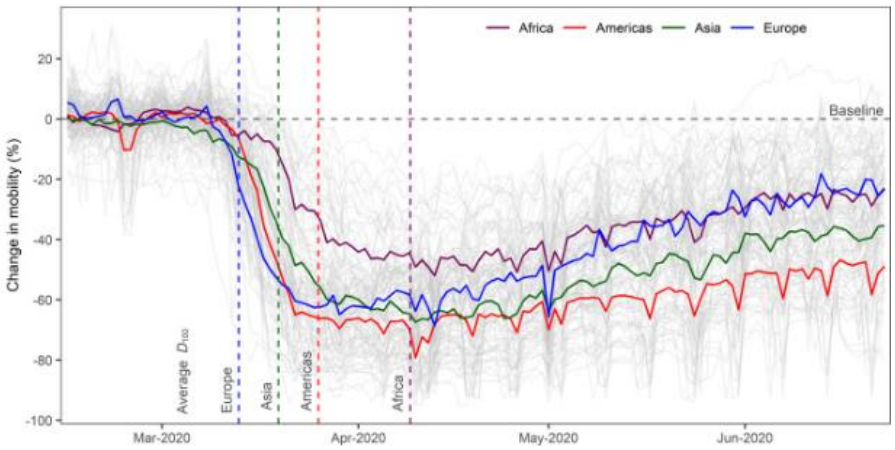

Figure 2: Evolution of the average mobility of people in transit by continent (Corpus-Mendoza et al., 2020)

3.1.2. Prioritizing cooperation

The COVID-19 pandemic has seriously tested the resilience of the world's city centers. This has led to a rethinking of priorities, a questioning of lifestyles and an awareness of alternative urban designs. The Civitas project (Civitas, 2011) created a list of stakeholders it would be necessary to include in order to alter urban mobility. First, we have the key players who will ultimately be affected by measures, either favorably or unfavorably (such as citizens, various social groups or professional associations, city districts, business branches, individual organizations, etc.) Second, Key Actors, or those with influence over politics, wealth, power, expertise in the transportation industry and related sectors, as well as people who are well-liked and respected by the locals. Finally, those who spread information and report on transportation, such as authorities, transportation firms, and the media, are those with ongoing interest representations, such as associations, chambers, and NGOs. Each of these actors helps to improve and encourage the integration of measures, which afterwards enables users to move about with ease.

The governance is at the center of the transition to sustainable urban mobility. The active involvement of numerous public and private actors is required to implement intermodal systems. In order to control their potential, it has also been noted that public transportation providers are making more of an effort to become Mobility as a Service (MaaS) operators, as noted by Hirschhorn et al. (2019).

Lindenau & Böhler-Baedeker (2014) also emphasize the need of involving users in the decision-making process when planning for sustainable urban mobility. For them, this will provide them the ability to express their concerns, propose novel ideas, and be motivated to take action and promote sustainable practices. Authorities and operators will simultaneously learn more about urban mobility issues from the perspective of users.

3.1.3 Shared mobility and micro mobility

Urban environments and urban mobility system requirements are changing in a society that is changing, which can present both opportunities to accelerate or bring about positive change as well as challenges, such as pandemics. As a result, the socioeconomic environment shifts and develops, posing new challenges for urbanism and necessitating an updating of mobility requirements.

Mobility shared, which includes shared fleets of vehicles (such as cars, motorcycles, bicycles, scooters, etc.) and carsharing models for users who want to make the most of their personal vehicle, is a new player in the multimodal transportation system. The market for shared mobility services is growing quickly, which helps the automotive industry achieve the necessary level of diversification. Thus, bicycles and other personal transportation devices like scooters become a key component of sustainable urban transportation systems. A better integration of bicycles and public transportation may be made possible through bicycle sharing programs (Büchel et al., 2021).

In terms of shared mobility, McKinsey suggests a greater uptake of shared mobility and electric vehicles following the European crisis (McKinsey, 2020). In addition, the culture of sharing goods and services, as well as access to and use of goods and services, are increasingly valued in comparison to property in a number of demographic groups (Hamari et al., 2015). Commonplace sharing programs for mobility devices like bicycles, scooters, and cars, as well as the subtle decline of the individual automobile as a sign of social status, are examples of this trend (Belk, 2014). These mental shifts among society as a whole are crucial because, in order for the car to be reduced, it cannot be imposed from above

according to a strictly technical vision. Instead, it must be based on societal debate and consensus while taking into account the right to free choice of citizens and economic actors, especially since the car is still regarded as one of the most comfortable means of transportation (Willing et al. 2017). It is reasonable to assume that emerging collaborative economy models will aid in the exploration of novel mobility solutions. It would be possible to create economic models that are better suited to the complexity of urban mobility needs from a socioeconomic perspective by fostering more complex and fruitful interactions among the various actors, including government agencies, private businesses, nonprofit organizations, and individual users.

Here, the COVID-19 crisis had a slight impact on the sales of internal combustion vehicles in Belgium in 2021, which decreased significantly (- 28.54%), while the sales of electric vehicles increased by 170% with 1,278 units in 2020 against 3165 in 2021, in term of hybrid car the number increased from 11630 in 2020 to 23151 in 2021. Figure 3 (Iweps, 2022).

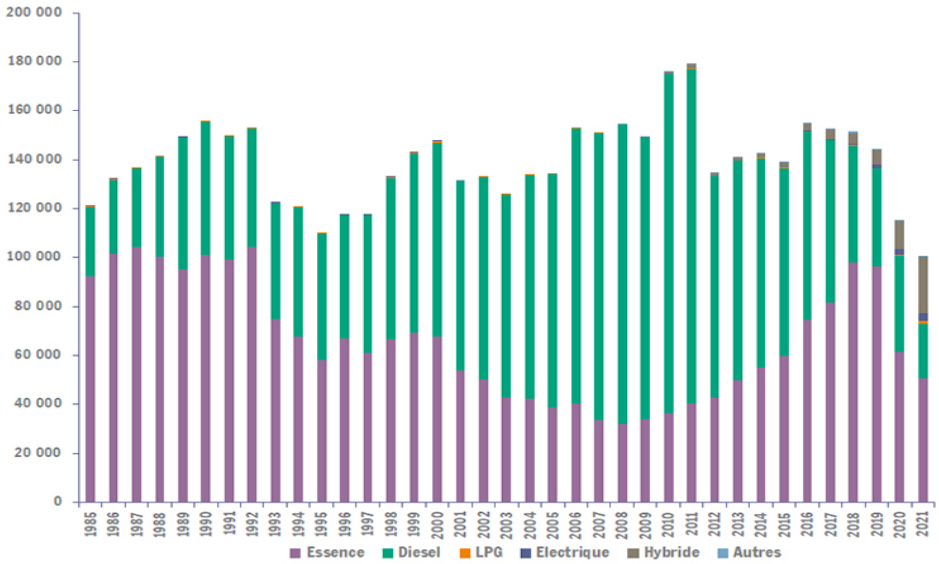

Figure 3: Evolution of the number of new passenger car registrations in Wallonia (Iweps, 2022)

New technologies, including the move to an electric vehicle fleet, are a key component of the change. Accordingly, as stated by Macharis et al. (2021), new technologies, such as the switch to an electric vehicle fleet, are a crucial component of the transition. This integration may take place through new political structures that grant privileges and subsidies to operators who join the system in exchange for sharing selected data with the public that is helpful for planning and monitoring the transportation system (Belk 2014).

Contrarily, according to Teixeira and Lopes (2020), the COVID-19 pandemic has caused a noticeably lower use of shared means of transportation. According to a summary of interviews conducted by the SPF Mobility and Transportations Secretariat with seven university professors, including professors Eric Cornelis, Bruno De Borger, Frédéric Dobruszkes, Michel Hubert, Imre Keseru, Dirk Lauwers, and Stef Proost, none of them agree that the rise of shared mobility, particularly that of electric scooters, is inevitable. According to specialists, such systems raise concerns about the safety of users and those they come into touch with as well as the working circumstances of those hired to replenish the batteries under the threat of failures. It is also emphasized from an environmental standpoint since

scooters typically have a limited lifespan and may frequently not be repaired or recycled (SPF) « Mobilité et Transports, 2020).

Even if it sometimes replaces certain trips, micro mobility is widely seen by cities as a way to get access to public transportation. According to Giulia Oeschger et al. (2020), the combination of micro mobility travel options within a single chain of travel can expand the spatial reach of public transportation, improve door-to-door accessibility, expand its cargo area, and offer a sufficiently affordable alternative to driving a car. Making micro mobility options more appealing may help combat the epidemic's tendency to push people toward individual mobility by giving more public space over to durable transportation methods.

In contrast, the Heineke et al., (2020) study showed how consumer concerns over choosing shared micro mobility services have changed over time, both before and after COVID-19. When making personal, professional, or long-distance trips, the time of travel was the main concern, but in the post-pandemic era, users appear to be more concerned with the possibility of the infection spreading. However, the reduction of the automobile cannot be imposed from above from a strictly technical standpoint; rather, it must be based on social consensus and debate while taking into account the constitutional rights of citizens and economic actors to freedom of expression (Willing et al., 2017).

The full impact of the pandemic on the mobility industry as well as future developments was also examined by McKinsey, 2020 over three time periods (figure 4) with the short-term impacts that lockdowns had on micro mobility, they look alike of the medium-term outlook, full recovery, and return to normalcy for micro mobility and how will the pandemic affect the 2030 transportation market modeling over the long term. And we can see that Mckinsey predicts that by 2030 micro mobility will grow and potentially be preferred by the public over public transport. But this will be thanks to the different hygiene measures that will have been put in place, the fact that this type of mobility will avoid traffic jams and pollution, and the improvement of cycling infrastructures.

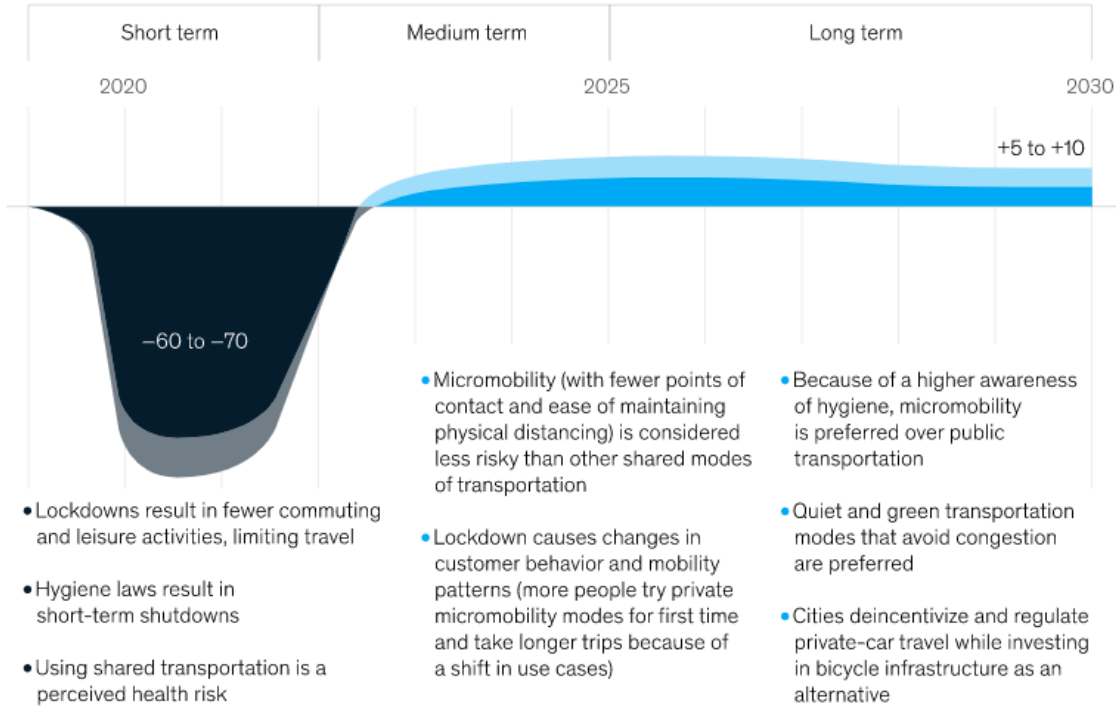

Figure 4:Figure 4: Impact of Covid-19 crisis on global and private micromobility (McKinsey, 2020)

3.1.4 Development of infrastructure

As we all know, the COVID-19 pandemic has disrupted daily life and forced people to reconsider their travel plans. In fact, throughout the Pandemic, public transportation was given less priority, and demand for individual mobility in the form of bicycles increased (Tirachini & Cats, 2020). A number of empirical research have looked at what prevents people from riding (Manaugh et al., 2016), and safety has come up repeatedly as a major issue. According to Pucher & Buehler (2016), the main strategy to encourage the use of bicycles and increase bicycle safety include providing and improving bicycle infrastructure. Cycling paths can provide significant benefits to cyclists while also potentially providing solutions to a number of issues, such as traffic, greenhouse gas emissions, air pollution, and providing additional health benefits, provided they are properly built (Gu et al., 2016). Additionally, studies conducted by Rietveld and Daniel (2004) found that the quality of cycling trails enhances the appeal of bicycles by increasing travel speed, network interdependence, and sense of security. According to the summary of the meeting with the seven university (SPF) « Mobilité et Transports, (2020) the rise in the number of people riding bicycles calls for both the development of quality bicycle infrastructure and two-wheeler shelters. Given that cycling has a low risk of pollution, it would be necessary to better adapt infrastructure in order to prevent conflicts with cars as people continue to use cycling as a form of physical activity. In general, it is acknowledged that the availability of bike parking choices, especially safe and secure ones, increases the appeal of using bicycles (Martens, 2007). Regarding parking infrastructure, there ought to be bicycle racks near public transportation hubs, secure parking areas to discourage fliers, and bicycle stands on walkways that may or may not be covered. As the number of people using bicycles increases, parking spaces must be controlled.

Some of the professors cited in SPF "Mobility and Transportation (2020) take their thinking a step further and believe that financial incentives, such as bicycle insurance, subsidies for the purchase of electric bicycles, or the provision of workers with electric bicycles in place of company cars, would influence more people to choose bicycles. Even though there are some unanswered problems regarding how to evaluate bicycle infrastructure projects, as noted by Ruffino and Jarre (2021), the value of increasing the comfort, safety, and duration of bicycle trips is sufficient to encourage the implementation of these measures.

With regard to walking, the temporary measure of pedestrianizing particular areas has been announced in some cities, including as Vienne (COVID Mobility Works, 2020). In addition, cities like Cardiff or Amsterdam have given their commercial districts and central city streets a distinct character to ensure that social distances are respected.

3.1.5 Development of the Transportation Offering

According to the interview summaries of the professors cited in SPF "Mobilité et Transports (2020)" it would be crucial to improve the transportation options that are offered throughout the day. After considering their thoughts, it might be possible to reevaluate the arrangement of work and school hours, and to have the latter ones taken into account by public transportation providers to lessen the impact on peak hours. Given that this model has already been adopted in Montréal, its implementation in Belgium, more specifically in the city of Liege, would provide an opportunity to demonstrate its viability and assess its effectiveness within the framework of a plan to mitigate the potential effects of infectious diseases on mobility. Additionally, the use of telecommuting and flexible hours may release travel from rigorous time constraints, which may help to increase demand for transportation during

peak hours. On the other hand, another group of experts sees a potential issue with this suggestion, to lower fares during off-peak hours instead of increasing them during peak hours, but can be done only if the public transport offer maintains a good frequency and reliability during off-peak. Gkiotsalitis & Cats (2020) mention additional measures as a part of tactical planning like station skipping, strategic planning like frequency reductions, or operational planning like crowd control, vehicle holding, and speed control.

Although some initial limits on the use of public transportation have since been lifted, passengers remain wary, and levels of concern about the cleanliness of public transportation are higher than they were prior to the implementation of the COVID (Beck & Hensher, 2020). According to the authors Shelat et al., (2022), risk perceptions can therefore have a significant impact on the levels of use of public transportation during the lockdowns periods and possibly even in the post-pandemic era, in addition to having an immediate impact on travel decisions and the trade-offs made between speed and crowd size. And changing work practices, including working from home, have influenced all forms of transportation and have also contributed to lower ridership levels have not helped (Gray, 2020). As a result, there is a great deal of uncertainty in regards to forecasting demand throughout the many stages of this unprecedented crisis.

A number of train and bus operators have reduced the frequency of their services to less than one-third of pre-pandemic frequencies according to Tan.C (2020) while also altering vehicle schedules and operating times. Limiting passenger embarkations is another real-time control measure that may prevent a surprise attack. Additionally, there are other models created to determine which stops a bus or train should skip when it is loaded (Wang et al., 2014). The creation of models that determine the maximum number of passengers that can board has been more important over the past decade, and it has primarily been used to prevent overcrowding in buses and trains. There are also models that determine the maximum number of passengers that can be carried at once while still meeting physical distance requirements by substituting the vehicle's recommended capacity for the nominal one (Puong & Wilson, 2008).

3.1.6 Fostering intermodality

The definition of intermodal transportation is "the movement of people and goods using more than one mode of transportation in a single, seamless journey" (Jones et al., 2000). This type of transportation emphasizes the use of combinations and offers the advantages of several modes of transportation as an alternative to the use of personal vehicle, depending on immediate needs. This is part of an urban mobility concept that places an emphasis on minimizing the use of automobiles in urban areas. What really benefits users is that the multimodal system can be customized to meet their needs and preferences. Here, the user can choose the travel combination that best suits their needs and preferences for the trip that is the fastest, cheapest, greenest, or least disruptive. Combining different modes of transportation into a single chain of trips can expand the spatial reach of public transportation, increase its accessibility at points of entry, expand its cargo space, and provide an affordable alternative to the car (Giulia Oeschger et al., 2020). According to the professors questioned by the SPF "Mobilité et Transports (2020)," the key to success is quality improvement. For instance, a more integrated sharing of the many means of transportation will increase interest in public transportation. They believe that in this situation, it would be beneficial to capitalize on the current enthusiasm for cycling in order to encourage more people to use public transportation. This means that it is feasible to envision the rail and bicycle combination, but it requires the availability of shared bicycles close to the stations, the expansion of bicycle parking spaces, and the provision of options for

storing one's own bicycle. In other words, mobility as a service (MaaS) appears as a way to respond to an open intermodality (Willing et al., 2017). According to the authors Pucher & Buehler (2009) the use of bicycles is significantly more cost-effective than using neighborhood buses or parking for cars in the zone of commercialization of public transportation stations, which results in an increase in the use of both modes of transportation. With access to public transportation, cyclists can cover longer distances and have a backup plan in case of bad weather, challenging terrain, or mechanical difficulties (Pucher et Buehler, 2009). Martens (2004) shows that faster and better-quality forms of transportation, like trains, draw many more people who ride bicycles than slower and less-quality modes of transportation, like local buses and tramways. In the same spirit, Van Mil et al. (2020) show that people are particularly willing to ride their bikes further to a station if doing so will spare them from having to transfer during their subsequent train trip.

Combining different modes of transportation into a single chain of trips can expand the spatial reach of public transportation, increase its accessibility at points of entry, expand its cargo space, and provide an affordable alternative to the car (Giulia Oeschger et al., 2020). In fact, according to CIVITAS, 2020 intermodal solutions may be less expensive and therefore more accessible when they are effective; however, the development of intermodal homogeneous systems requires significant innovation, and in some areas, they still have a way to go. Additionally, during the calibration phase, multi-modal solutions can assist in easing the demand pressure on bus systems. Passengers may be required to switch from buses to shared bikes or scooters when bus occupancy surpasses the limits caused by social distance, for example. Such a plan would guarantee ongoing mobility while lowering infection risks (Martin, Richert, & Schrader, 2020).

3.1.7 The 15-minute city

The unprecedented COVID-19 health crisis and climate change have highlighted the vulnerability of urban environments and the need for a response to handle these major global shocks. The most striking observation as cities struggled to prepare for the second wave of the global pandemic may have been how long it took people to get to work each day and the lack of equipment at the local level (HBR, 2020).

The 15-minute city approach, which is described in the literature as the maximum amount of time individuals are willing to walk and also the equivalent in terms of lengths, such as 800 m to be able to satisfy daily needs locally (Badland et al., 2014), appears to be a fairly good model for the functional and spatial organization of the neighborhood as well as the city. The "neighbourhood unit" concept, which was created in 1923 for the city of Chicago as part of a competition to define compact residential neighborhoods where the proximity of services and homes helped to define that area's identity and character and to foster "the feeling of belonging" of a community to a place, is where the 15-minute city got its start (Gaglione et al., 2022).

By integrating the localization and service distribution and open spaces, the characteristics of the network, and the "needs" associated with the behavior of different population segments, Gaglione et al. (2020) showed that in order to improve the walkability of the urban built environment, a systemic approach should be used. According to authors Church et al., (2000), one of the main ways for people to access opportunities that are spatially distributed in urban environments is through proximity, or better yet, geographic proximity, which is defined as the placement of people, services, and activities next to one another. Therefore, strategies centered on proximity, which are more dissimilar from strategies centered on accessibility, introduce local access of people to a wide range of essential equipment for quality of life as a fundamental principle of territorial planning. These facilities include

healthcare facilities, pre- and post-secondary educational institutions, social and commercial services, recreational and cultural facilities, parks, and open spaces (Solá & Vilhelmson, 2018). This list is illustrative rather than exhaustive.

The idea of a 15-minute city, according to an international association of mayors concentrating on climatic changes and sustainability, might aid metropolitan regions in recovering from the financial damage caused by COVID-19 (C40, 2020). The events of the past year strongly re-propose experimenting with this strategy, also in accordance with the mayor of Paris' proposal, with the aim of giving Paris a new look by establishing extensive pedestrian green spaces on the wide boulevards that are currently traversed by cars and enabling the city's citizens to reach essential urban services by foot within the 15-minute limit (Gaglione et al. 2020). Other cities, including New York and Milan, have started to make their neighborhoods, particularly the outlying ones, accessible in 15 minutes on foot or by cycling while simultaneously focusing on making these neighborhoods desirable locations for local communities to socialize.

An overview of Plan Melbourne 2017–2050, a long-term strategy that is comparable to the 15-minute city concept and tries to address the issues given by a constantly expanding population and employment, is provided in figure 5 (Metropolitan Planning Strategy, 2016). These include providing appropriate and accessible housing, assuring a sufficient number and variety of jobs, preventing urban sprawl, ensuring adequate and accessible transportation, reducing greenhouse gas emissions, and adapting to predicted effects of climate change.

Figure 5:The 20-minute neighborhood Plan Melbourne 2017–2050 (Metropolitan Planning Strategy, 2016).

Being close to all of these amenities necessitates a significant amount of local service and facility decentralization in order to balance out variations between regions within the city. In turn, this presupposes a hierarchical arrangement of public services and a suitable transportation system for the

effective organization of the associated facilities, relying on the facilities' market range and threshold demographics (The Geography of Transport Systems, 2022).

This entails a shift away from traditional office duties and rigid work environments and toward a variety of alternative or hybrid work patterns based on what people want to do or need to do. This could materialize in the neighborhood through the addition of new office spaces locally, the development of coworking spaces, or the redesign of existing office spaces to better serve the needs of the neighborhood community (Everett, 2020). More importantly, such major changes call for new employment allotment models that can only be implemented with coordinated efforts and communication with corporations and companies. These efforts should aim to persuade them to reduce the right of employees to be present in physical workspaces, re - allocate their central offices, and change their work styles to more hybrid.

Finally, according to Yang et al. (2018), the strong accessibility of some neighborhoods and the development of neighborhoods with high proximity go hand in hand with an increase in property values, bringing about either gentrification phenomena or the confinement of modest households to more affluent areas. However, given annoyances like emission, noise, vibrations, and radiation, some kinds of public services, such as hospitals, airports, and mobile phone towers, may have a detrimental effect on neighboring property prices.

Chapitre 3 : Contribution

This chapter will go into the procedures used to collect and analyze the data for this study, as mentioned in the introduction. The approach used identifies the impact of COVID-19 on urban mobility, therefore meeting the study's goals. The study's objectives and questions about modifications in commuting to and from work practices in the city of Liege before the Covid-19, during and after the lockdown, require a significant sample of respondents. As a result, an inquiry that uses a quantitative methodology is used.

4.1 Survey

A custom survey was utilized to collect the information needed to understand the respondents' opinions. In order to document respondents' indicated preferences for mode selection during the Coronavirus pandemic as well as the variables influencing this choice, a survey was developed. This survey was created to elicit responses from Liege inhabitants and employees in order to provide a comprehensive picture of mode utilization during commuting.

The distinguishing characteristics of the respondents were collected but their names were hidden. The survey included 44 questions. As a result of the use of skip and display logic to present the desired items based on previous responses, the majority of respondents saw fewer questions than the total 44. The first portion of the survey allowed for the gathering of socioeconomic data specific to each respondent, such as age, sex, professional category, or make-up of the household, as well as the presence of a vehicle and/or a driving license. The second section of this study focused on respondents' travel patterns throughout time periods before the advent of the Ccovid-19 pandemic, as well as during and after the confinements. Particular attention should be paid to the frequency of use of various modes of transportation, the use of shared or micro mobility modes, as well as opinions regarding the distances at which it will be preferable for city amenities should be found.

To ensure that the information from the predicted responses was captured, the survey was developed and tested in March 2022. After modifications were made in response to test respondents' input, the survey was then completed. On April 5, 2022, the initial survey announcement was distributed. The poll had a deadline of May 10, 2022, and respondents had one month from the date of publishing to complete it. This time frame was chosen since it allowed for the collecting of the right number of responses and offered a length of time for opinions to change. The survey's questions are listed in the appendix.

4.2 Platform

Qualtrics XM was the survey platform used to develop, distribute, and conduct a basic survey analysis. The choice of Qualtrics XM was made based on its overall interface and simplicity of usage. This platform provided a tool for survey design, real-time survey editing, and analysis and management of the response data. Users were able to navigate the survey easily by moving forward and backward using the responder interface for Qualtrics XM. By offering potential respondents an anonymous link, Qualtrics XM also made it simple to distribute the survey. Each question was also provided with quick proportionate response statistics by Qualtrics XM. Additionally, it included cross-tabulation and other analysis tools that were useful for the data processing procedure.

4.3 Survey Coding

The coding of the survey was utilized to produce understandable, transparent results. Each question was built expressly to request the required data. Multiple-choice questions with predetermined responses gave the respondents a thorough picture while being concise and easy to compare with one another. It was simple to compare the preferred modes between the three inquiries since the same wording and answer options were used in the questions meant to compare the times before the COVID-19 crisis, during the lockdown, and after the lockdown.

4.4 Marketing

In order to gather a sizeable sample size for the study and due to the many advantages that conducting an online survey offers, as stated by Wright (2005), we have chosen to publish the survey online. The poll was promoted through social media platforms and networks for direct group communication. Facebook was the most widely used marketing platform. Regular postings on several Facebook pages that catered to the city of Liege were used to promote the survey. To avoid, or at least to reduce, the underrepresentation of an older population due to lack of internet access or ignorance of its use, paper versions of the questionnaire have also been distributed. Additionally, we forwarded the study's URL to certain group members who, based on what we understood, didn't utilize social media. This study supported several predictions about the impact of several variables on urban mobility during the Coronavirus pandemic. Inquiries that allowed for the collection of socioeconomic data unique to each responder, such as age, sex, professional category, or family composition, were incorporated into the questionnaire's design. We also looked at respondents' travel behaviors, including the frequency with which they use different modes of transportation, as well as whether they own a car and/or a driver's license, based on these demographic parameters.

The first part of the survey allowed for the gathering of socioeconomic data specific to each respondent, such as age, sex, professional category, or make-up of the household, as well as the presence of a vehicle and/or a driving license. The second section of this study focused on respondents' travel patterns throughout time periods before the advent of the Covid-19 pandemic.

as well as during and after the lockdowns. Particular attention should be paid to the frequency of use of various modes of transportation, the use of shared or micro mobility modes, as well as opinions regarding the distances at which essential city amenities should be found.

Research questions

In order to explore the impact of the Covid-19 on urban mobility in the context of commuting in the city of Liege, a descriptive analysis of the results will be conducted. This exploration is structured around three main themes. First of all:

- Urban public transport ridership levels before the Covid-19 pandemic, during and after the lock-in period.

- The extent to which users would accept the implementation of shared mobility and micro-mobility if all operational details were better secured around them.

- Arguments for the adoption of the 15-minute city concept

The majority of the 44 questions had closed-ended answers. In their 2022 article, Baburajan et al. discuss the advantages and disadvantages of using closed-ended questions. One advantage is that if respondents have little work to do and the response time is quick, they may be more inclined to answer later questions.

However, closed-ended questions can be problematic if the respondent has to choose one of the answer options that may not fully match what they think is the answer to the question. However, we believe that the benefits are based on potentially incorrect answers because we constructed the survey so that if a respondent is unsure, one of the options should always be the closest. In addition, a few questions are worded in such a way that the respondent should be able to estimate his or her travel patterns rather than being sure of the answers. We ended the survey after obtaining 405 responses so that we could compile the information collected.

4.5 Statistical Techniques

The data was cleansed before analysis by deleting survey responses that weren't enough to analyze. Any surveys that had been completed less than 50% were among those discarded. This number was used since respondents who had completed at least 50% of the survey had provided information for the analysis to question 36 or later.

To understand the most prevalent opinions and how others deviate from them, mean, median, and variance were employed. The median is the outcome with the most mid-range value, while the mean is the average result from a data collection. Determine whether there are significant outliers that significantly deviate from the true average using the median. The range of the data set's results is known as variation. Many of the survey's variables were compared using these straightforward statistics.

4.6 Calculating the Sample Size

Based on a preferred 95% confidence interval and a 5% error margin, the predicted sample size was calculated. As of January 2022, the city of Liege has a population of 194638, therefore 384 respondents were deemed to be the ideal sample size (Survey Monkey, 1999). The desired sample size was determined using the formula below.

$$\text{Sample size} = \frac{\frac{z^2 * p(1-p)}{e^2}}{1+\left(\frac{z^2 * p(1-p)}{e^2 * N}\right)}$$

Where: N is the population size
e is the margin of error
z is the z-score, determined by the confidence level
p is the likely sample proportion (Survey Monkey, 1999)

The number of standard deviations from the data's mean is the z-score. Using a z-score of 1.96, a confidence interval of 95% was calculated. Since the sample fraction wasn't determined, 50% was used as the identical value. This sample size, confidence level, and margin of error show that, with 95% certainty, the findings of a survey of the full relevant population—in this case, the 194638 individuals—

would be within 5% of the findings of the survey of the 384 sample size. A total of 453 participants answered the poll after the two-month data collection period. With this sample size, the obtained data set has a margin of error of 4.88%, which is slightly better than expected.

Population	194638
Error margin	
2%	2372
3%	1062
4%	599
5%	384

Table 1: Margin error calculations (Author, 2022)

Chapitre 4: Results

This chapter will present and detail the findings of the investigation's data. The analysis' findings will be discussed. The study question and any supporting hypotheses are included in the conclusions, which are discussed in Chapter 2. These findings will also assist decision-makers in better comprehending rider preferences, giving them better information and direction in the event that an illness disrupts urban mobility.

I collected 453 responses, but only 404 of them had completed the questionnaire to a level of 50%. As a result, a sample of 403 answers will be used for all subsequent analysis. I have split the Liege population by sex and age as I was gathering my data.

5.1 Socio-demographic analysis

I tried to follow the sex and age-based demographic segmentation in Liège as I collected my data to make sure that my sample was representative. I checked the response rate quotas. As a side note, I sought to target these surveys by sending personalized emails to the folks I required in order to be able to meet these quotas. I may therefore conclude that my sample is nearly representative of the population in terms of age and sex categories since the percentages of respondents by age and sex categories were nearly identical to the distribution of the Liege population (Statbel, 2022). Generally speaking, quotas were as follows, as shown in the table:

	Population %	Respondent %
Man	49.6	45
Woman	50.4	55
Total	100%	100%

Table 2: Respondent's gender

We can find in table 3 the detailed table of frequencies per age group. I used the skip logic function of Qualtrics when coding my survey, in order to avoid students and people under the age of sixteen so these are less interesting classes for this study and therefore should not pose a problem of representation. In order to enable future analyses, the ages have been grouped as you can see.

Age distribution	Population	Respondant
-15	16.3	9
16-24	10.4	13
25-64	54.2	55
65+	19.1	23
Total	100%	100%

Table 3: Respondent's age

With respect to the level of education of the respondents, we can observe that most of them have at least a bachelor's degree (see Table 13). Approximately 70% of the sample represented a population with a high level of education (from bachelor's degree to PhD).

Education level	%
Less than high school	3.31
High school graduate	25.40
Bachelor's degree	22.23
Master's degree	47.07
PhD	1.99
Total	100 %

Table 4: Respondent's education level

Lastly, regarding the monthly net income is an important predictor for current and future trip making and activity engagement. Results from the stated preference survey show that one-fifth of the respondents belong to households that brought in less than 1999 € per month (Figure 6). In contrast, another one-fifth of the respondents belong to households that brought in at least 4500 € per month.

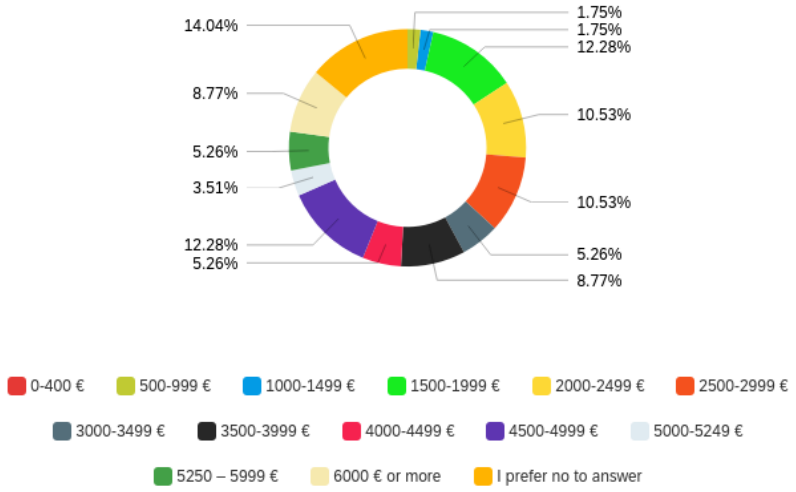

Figure 6:Respondent's monthly net income

5.2 Commuting travelling distance

Looking at the distances separating the respondents' homes from their workplaces, we can observe that 55.55% of the respondents have their workplaces more than 30 km from their homes, 1.39% between 20 and 29 km, 5.56% about 15 km and 9.72% less than 4 and 10 km with 84.93% of the respondents, that is 338, having a driver's license.

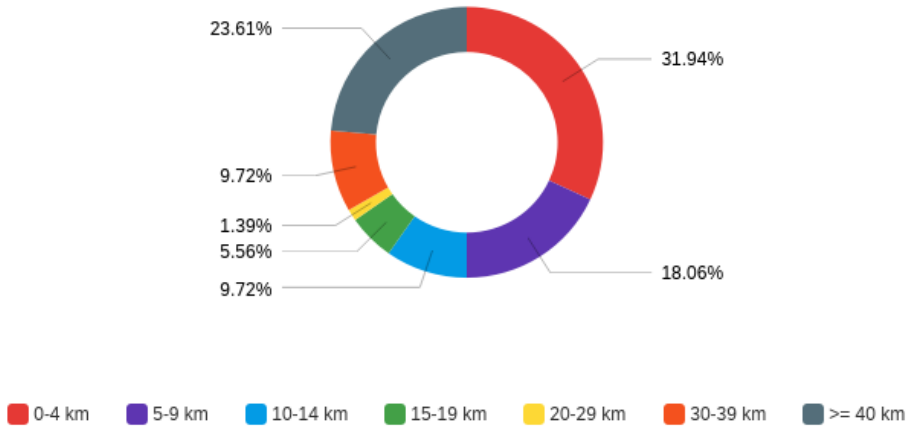

Figure 7: Commuting travelling distance

5.3. Teleworking

In order to shed some light on the possible consequences of the Covid-19 health crisis on the mobility of working people, we asked how often they used teleworking during the week for the periods before Covid-19, during and after containment

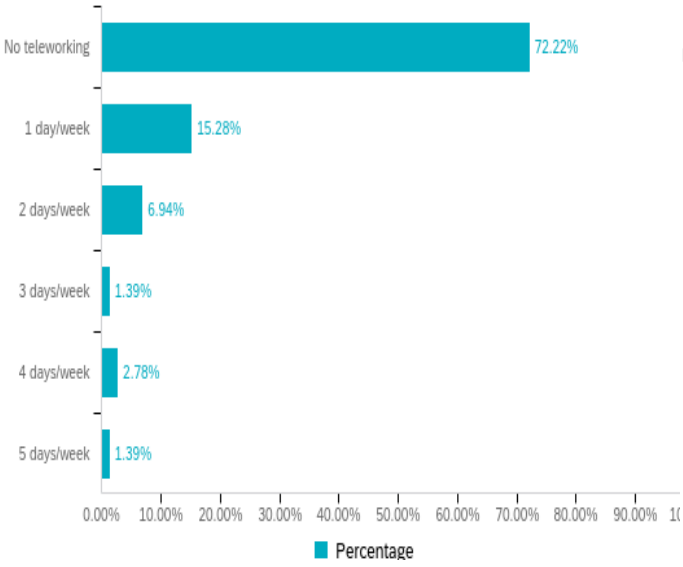

Figure 8: Teleworking during pre-Covid

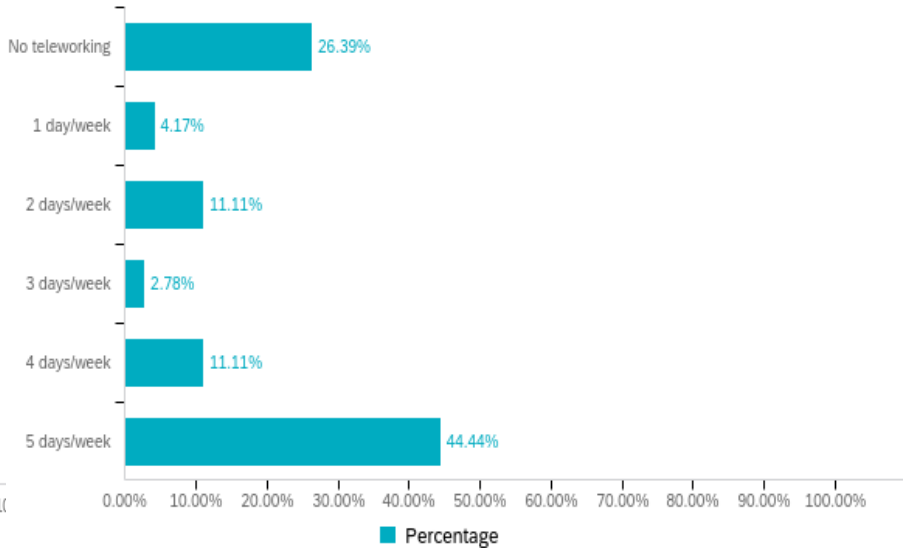

Figure 9:Teleworking during strict lockdown

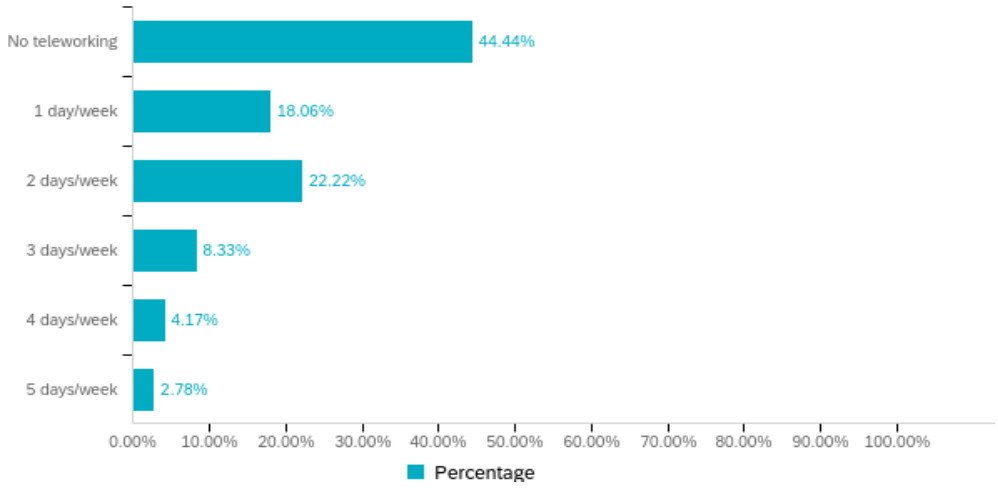

Figure 10: Teleworking after strict lock down

Figures 8, 9, and 10 illustrate the impact of the Covid-19 health crisis on telecommuting. Teleworking is one of the means implemented to fight against the spread of the coronavirus, by limiting the number of trips. The data show a very clear increase in the number of days of teleworking when the population of Liege entered the containment. The average of 5 days per week of telework went from 1.37 % for the period before the sanitary crisis, to a rate of 44.44 % during the period of confinement and then went back to a rate of 2.78% after confinement which is slightly higher than the rate corresponding to the initial period i.e. before covid-19. While this is not spectacular, it should be noted that such an increase (1.38%) would already have a significant impact on traffic.

5.4. The main means of transport used by users

The following chart shows what is generally the primary mode of transportation used by respondents. All 403 respondents answered the question but were able to choose between several alternative answers. The main means of transportation chosen by the respondents in a decreasing order are:

- The train and the electric bicycle with respective frequencies of 21.7

- The car alone and the non-electric bicycle with respective frequencies of 20.3

- The TEC bus with a frequency of 7.2

- The car with family members with a frequency of 4.3

- And finally the car with colleagues, by motorcycle and walking with frequencies of 1.4%.

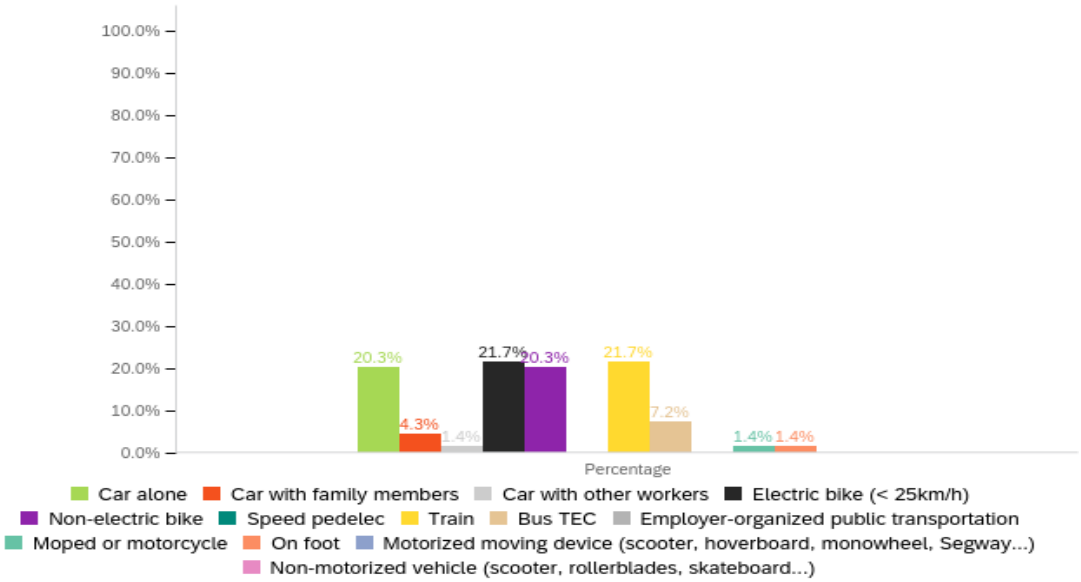

Figure 11:Users transport modes

5.5 The use of public transport

The daily use of public transport, especially buses, decreased significantly during the containment period and this decrease was in favor of the car.

Regarding train use, the frequencies according to the periods before the pandemic, during the containment and after the containment are respectively 18.46%, 9.6% and 11.11%. As for the use of the bus, the frequencies of use following the same periods are 10.77%, 3.2%, 6.35%. There is a clear drop in the percentage of workers using public transport especially buses on a daily basis during the containment period, but the frequencies fluctuate slightly upwards after the containment. and this decrease was in favor of the car. This finding can be attributed to a number of factors, such as a decrease in supply during this period or fear of incurring a health risk and being exposed to contamination. Attendance may also be influenced by the abundance of other modes of transport available to potential users. When other modes, such as personal vehicles, are readily available, they may be used much more than transit for convenience. However, when these other modes become inconvenient, costly, or inefficient and transit offers these factors, the user is more likely to choose it.

The Covid-19 health crisis has led us to question the potential health risks involved when we travel. In this respect, all modes of transport are not equal and public transport can suffer from a bad image, despite all the measures taken by the different operators.

Urbans transport modes	Before Covid-19	During lockdown	After lockdown
Car alone	22.07%	28.98%	17.46%
Car with family members	4.62%	1.6%	3.2%
Car with other workers	1.54%	1.02%	1.03 %
Non-electric bike	23.08%	24.3%	17.16%
Electric bike (< 25km/h)	15.38%	11.1%	25.40%
Train	18.46%	9.6%	11.11%
Employer-organized public transportation	1.54%	0.0%	0.00%
Bus TEC	10.77%	3.2%	6.35%
Moped or motorcycle	1.00%	0.0%	0.00%
On foot	10.77%	18.6%	16.09 %
Motorized moving device (scooter, hoverboard, Monowheel, Segway...)	1.54%	1.6%	2.2%
Non-motorized vehicle (scooter, rollerblades, skateboard...)	1.00%	0.0%	0.00%

Figure 12: Frequency of use of public transit by mode

The figure 12 shows the declared reasons for not using public transport. Respondents who indicated that they use public transport (train, bus) little or not at all were asked to indicate the reasons for these intentions. The distribution of the answers is illustrated below.

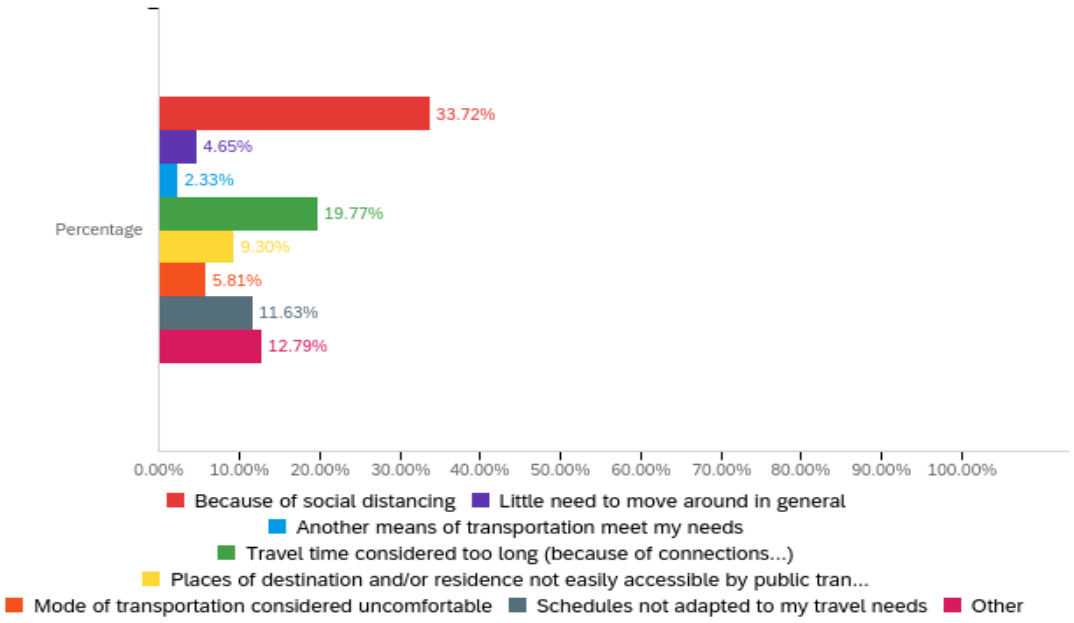

Figure 13:Reason of less use of public transport

In the survey, the respondents were asked to choose between a group of eight factors which were the ones pushing them to use not much more than once a week or not at all public transport system when deciding to use public transit. According to the data collected, we find that fear of contamination is the most important reason for respondents to use public transit less, with 33.72% of responses, followed by travel time considered too long with 19.77%, public transit schedules not adapted to needs with 11.63%, and poor accessibility by public transit to the targeted destinations with 9.30%.

The factors that were included in the survey were chosen because they encapsulate safety measures for combating the Coronavirus and important factors that travelers consider when choosing a mode for their trip.

5.6 Implementation of urban shared mobility and micro-mobility

When asked if respondents were registered on a carpooling or carsharing platform, 8 out of 10 respondents (82.46%) answered "no". Also, when asked if respondents had car-sharing stations near their homes (less than 3 km), 43.86% of respondents answered "I don't know", 22.81% answered "no" and 33.33% answered "yes". Finally, when asked if respondents were aware of the self-service electric scooter system, 89.47% answered "yes" and 10.53% answered "no".

Specifically interested in the use of shared transport modes before the Covid-19 pandemic, during the containment and after the containment period, respondents were asked to fill in the questionnaire according to their frequency of use on weekdays (Monday to Friday).

After analysis of the answers, we can see that respectively 2% of the respondents indicated that they used the shared car, the self-service scooters, and the shared bike "always" and "often" before the period of Covid-19, during the period of confinement only the use of the electric scooter drops to a rate of 2% for the answer "often" and 0% for the proposals of carpooling and shared bike. Finally, we observe a rate of 2% as the frequency of use of the self-service scooter for the "always" and "often" responses and 0% for the other two propositions.

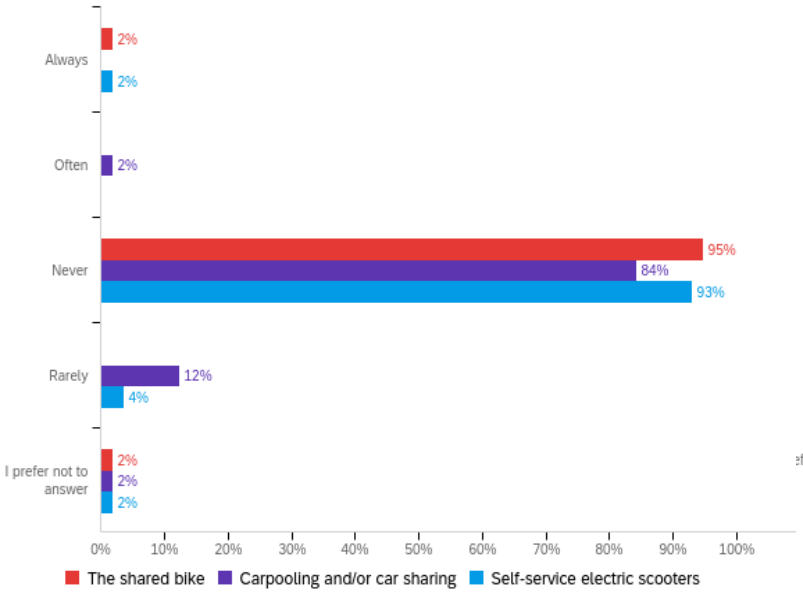

Figure 14: Shared mobility before Covid-19

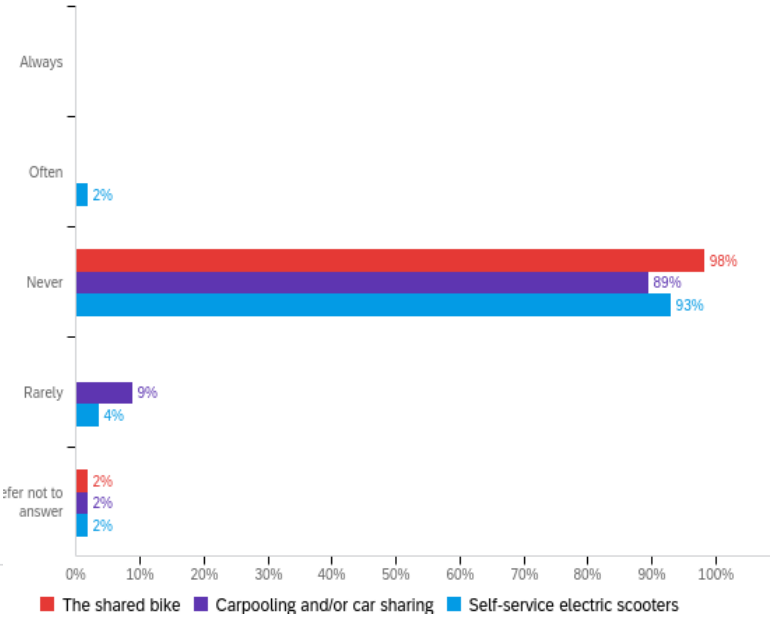

Figure 15: Shared mobility during lockdown

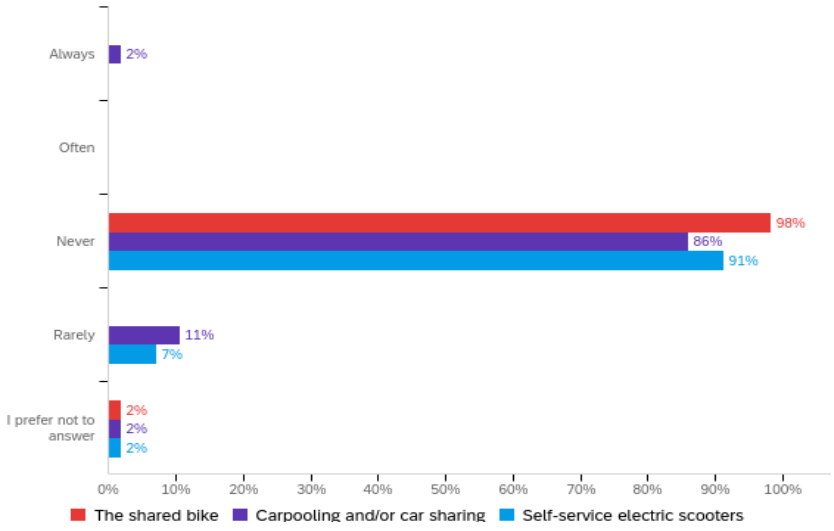

Figure 16: Shared mobility after lockdown

We are also interested in the reasons why the users use or not the shared mobility services. We can see that in the case of carpooling, the respondents say that they use this service little or never, with 40% stating that it is because they do not need it, 18% because of social distance, 14% because they do not have opportunities to do so near their departure and/or arrival points, 8% because it is too restrictive and not practical, and 4% because they do not trust the system.

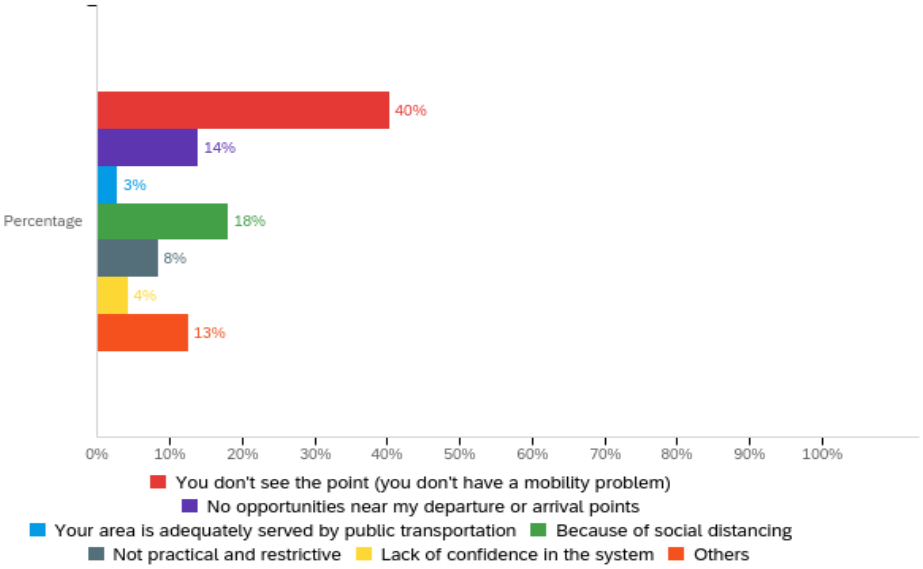

Figure 17: Reason of less use of carsharing

Regarding the bike-sharing services figure 17, respondents who have little or no experience with this service have: 50.60% declare that they already own their own bikes, 16.87% declare that they do not have an opportunity near their arrival and departure point, 18.14% respond that they consider the quality of the road to be poor and the road network inadequate, 9.64% declare that the distance they have to travel from home to work is too great and 3.61% declare that they do not have confidence in the system.

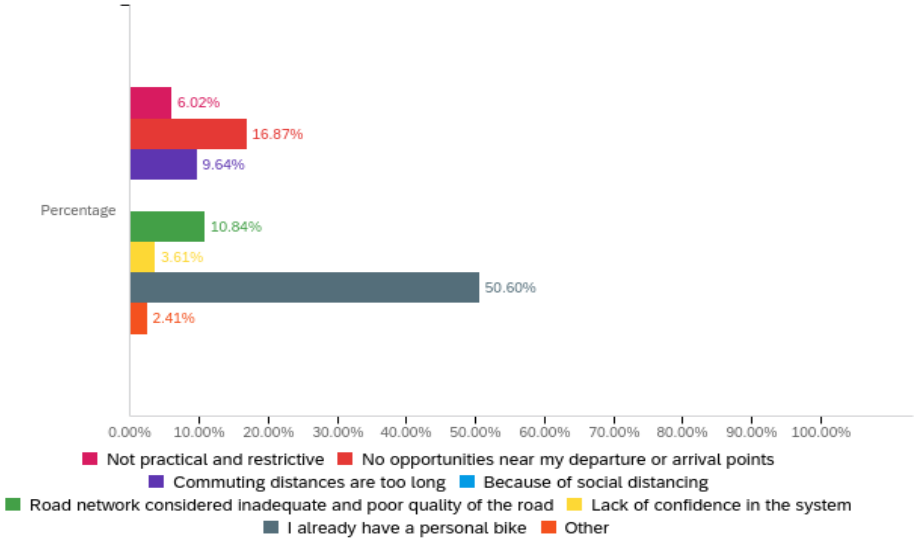

Figure 18: Reason less use of shared bikes

Regarding self-service scooter services figure 18, respondents who rarely or never use this service responded with decreasing frequency to :
- 28.81% said that they found it dangerous,
- 19.35 % judged the road network and infrastructure
- 13.98 % mentioned other reasons of other roads,
- 12.90 % mentioned that the distance between home and work was too long, declare that their commuting distance is too long
- 3.61% said they lacked confidence in the system

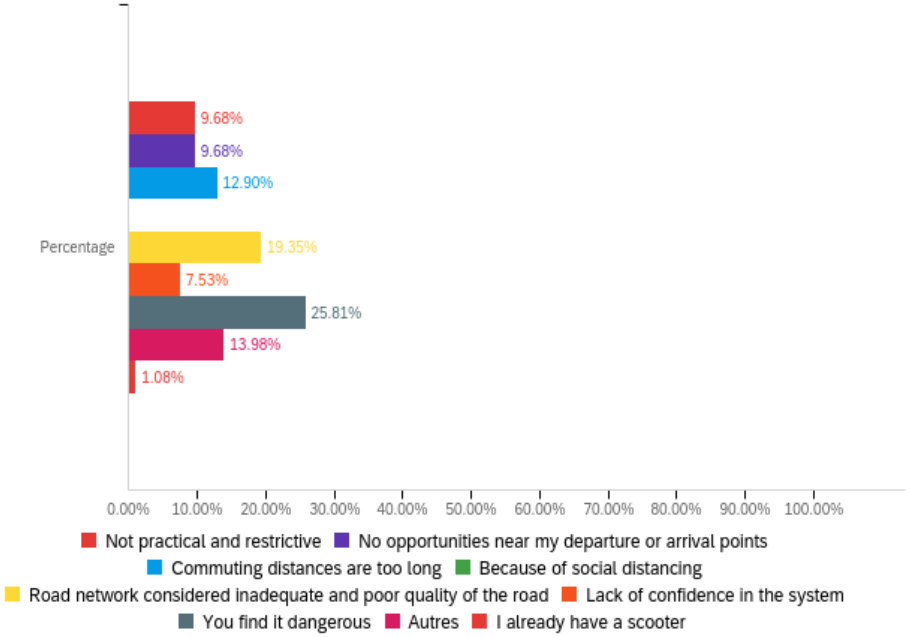

Figure 19: Reason of less use of electric scooter

According to our analysis we have found that almost 70% preferred to have bus stops located within 1 km, followed by small food shops with a frequency of 67%, then green spaces and pharmacy with a frequency of response of 53% respectively for each of the two proposals. With a frequency of 25% we have cafes and restaurants, with 21% we have police stations, and with less than 5 each high schools, hospitals, sports centers and bookstores.

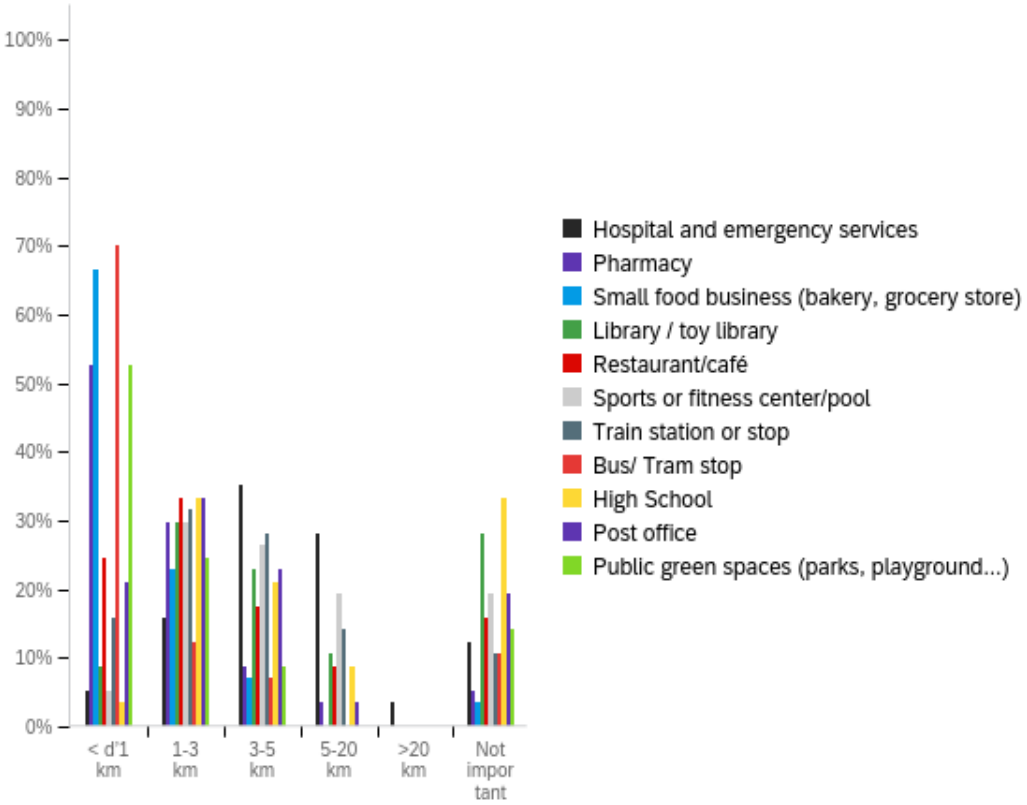

Figure 20: Preferred distance of city amenities

Conclusion and discussion

The purpose of this study was to determine how the COVID-19 issue affected Liège's urban mobility and how it might help the city's mobility transition to a more sustainable state. It was done using both primary data analysis and a thematic review of the literature. What can we infer from this at this point on the likelihood of a breakthrough in the migration to a more environmentally friendly transportation system? We'll talk about this in terms of the five actions for a sustainable transition.

The impact COVID-19 has had on our economy and society has provided an excellent chance to review and restructure the activities we have taken as global citizens in areas like business and trade, the environment, social relationships, and mobility. The rapid and immediate intervention strategies that were put in place as the pandemic started to unfold should be a main driver in how change can be affected on the transport system and the public sphere, for a more welcoming and adaptable future. Almost every jurisdiction in the world is preparing, or are part of the process of effective implementation, their post-pandemic economic recovery plan. The effects of the pandemic have created a concept of what some refer to as "a new normal," in which humanity is compelled to adjust and change from our pre-COVID-19 lifestyles to ones that involve taking precautions for public health and avoiding close contact with others on a physical and social level.

The actions taken by cities, which were first intended to be emergency response actions, can now offer city planners a set of core, basic ideas for developing urban environments that are capable of being adaptable, flexible, and flexible in the face of an uncertain future. The following lists some fundamental ideas that should be taken into account while making plans for a post-pandemic society: Making space plans

The epidemic has brought to light the necessity for us to design areas where physical distance is allowed. This pertains to transportation systems and calls for the creation of public spaces that encourage outdoor recreation at a safe distance as well as sole-user options like micro mobility services. However, this principle can apply to other modes of transportation within a city, such as biking and pedestrian infrastructure, and the redistribution of road space for other users and uses. This may not be as viable for public transportation services, where services that affirm strict physical distance requirements are typically operating at a loss. How crucial micro mobility is ridesharing, bike sharing, and scooter sharing are examples of micro-mobility choices that have shown to be valuable during the pandemic. As they are designed to provide transport to one person, these options have given people more opportunities to move around the cities in a physically distant way. This decreases the amount of human connection that one may have otherwise had if they had chosen public transportation. These systems offer additional capacity for the mobility of individuals for short excursions and where private cars are not available, and they complement the range of traditional transportation options already available in urban centers. These recent events have shown that micro mobility solutions are essential for the future of urban mobility and will remain relevant in the post-pandemic era.

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Appendix

Q00 Bonjour,

Je suis étudiante en sciences de gestion à HEC Liège. Je mène une enquête concernant l'impact de la covid-19 sur la mobilité urbaine auprès des personnes résidant dans la ville de Liège et âgées de plus de16 ans.
Ce questionnaire ne vous demandera pas plus de dix minutes à réaliser et est anonyme.

En validant le texte ci-dessous, vous déclarez participer volontairement à cette étude et acceptez le traitement de vos données.

Vos réponses me seront importantes pour la conduite de ma recherche de mémoire de fin d'étude.

Je vous remercie par avance de votre participation.

Cordialement,

Manuela Youdom,
Etudiante Master – HEC Liège (ULiège) / ma.youdom@student.uliege.be

○ Je participe volontairement à cette étude et j'accepte le traitement de mes données (1)

Appendix

Q1 Pouvez-vous inscrire le nombre de personnes résidant au sein de votre lieu d'habitation, y compris-vous-même ?

○ Indiquez ici (5) _____

Q2 Quel est le code postal de votre lieu d'habitation ?

- ○ 4000 (1)
- ○ 4020 (2)
- ○ 4030 (3)
- ○ 4031 (4)
- ○ 4032 (5)
- ○ 4040 (6)
- ○ 4053 (7)
- ○ 4420 (8)
- ○ 4430 (9)
- ○ Autre (10) _____

Q3 Quel est votre rapport avec le chef de ménage ?

- [ ] Chef(e) de ménage (1)
- [ ] Epoux (se) (2)
- [ ] Compagnon (agne) (3)
- [ ] Enfant (même adresse officielle ou autre adresse officielle) (4)
- [ ] Autre (5)

Q4 Quelle est votre profession ou activité principale ? Veuillez consulter l'aide ci-dessous

- ○ Ecolier / étudiant (e) (1)
- ○ Femme / homme au foyer (2)
- ○ Chercheur (se) d'emploi (4)
- ○ Ouvrier (ère) (5)
- ○ Invalide (6)
- ○ Cadre (7)
- ○ Employé (e) (non-cadre) (8)
- ○ Artisan, commerçant, chef d'entreprise (9)
- ○ (Pr) pensionné(e) (13)
- ○ Indépendant (e) (10)
- ○ Profession libérale (11)
- ○ Autre, précisez... (12) _____

Q5 Êtes-vous en situation de handicap ?

- ○ Oui (1)
- ○ Non (2)

Q6 Avez-vous la possibilité de faire du télétravail ?

- ○ Oui (1)
- ○ Non (2)

Q7 Combien y a-t-il de véhicules dans votre ménage ?
Prendre en compte les véhicules achetés, de société et les véhicules qui sont à votre disposition via d'autres systèmes comme le partage de voiture. Si votre ménage ne possède pas de véhicule de chaque catégorie particulière, veuillez saisir « 0 ».

- ○ Voiture/camionnette (1) _____
- ○ Moto /trottinette/ rollers/ skateboard/ hoverboard/ monowheel/ Segway (2) _____
- ○ Vélo (électrique/non électrique) (3) _____

Q8 Possédez-vous le permis de conduire voiture Catégorie B ?

- ○ Oui (1)
- ○ Non (2)

Q9 Depuis combien de temps possédez-vous votre permis de conduire de catégorie B (voiture) ? Veuillez indiquer une réponse en nombre d'années. Si vous avez votre permis depuis moins d'un an, indiquez 0.

- ○ Indiquez ici (4) _____

Q10 Quelle distance sépare votre domicile de votre lieu de travail ?

- ○ 0-4 km (1)
- ○ 5-9 km (2)
- ○ 10-14 km (3)
- ○ 15-19 km (4)
- ○ 20-29 km (5)
- ○ 30-39 km (6)
- ○ >= 40 km (7)

Q11 Quel est en moyenne le temps de votre trajet domicile-travail (aller-retour) ?

	<15 mn (1)	15-29 mn (2)	30-44 mn (4)	45-59 mn (5)	60-74 mn (6)	75-89 mn (7)	90-119 mn (8)	>=120 mn (9)
Aller (9)	○	○	○	○	○	○	○	○
Retour (10)	○	○	○	○	○	○	○	○

Q12 **Avant** la pandémie de Covid-19 à quelle fréquence faisiez-vous du **télétravail** ? (Une seule réponse possible)

- ○ Pas de télétravail (1)
- ○ 1 jour/semaine (2)
- ○ 2 jours/semaine (3)
- ○ 3 jours/semaine (4)
- ○ 4 jours/semaine (5)
- ○ 5 jours/semaine (6)

Q13 **Pendant** la période de confinement (interdiction partielle de déplacements) à quelle fréquence faisiez-vous du **télétravail ?** (Une seule réponse possible)

- ○ Pas de télétravail (1)
- ○ 1 jour/semaine (2)
- ○ 2 jours/semaine (3)
- ○ 3 jours/semaine (4)
- ○ 4 jours/semaine (5)
- ○ 5 jours/semaine (6)

Q14 Depuis **la fin** du confinement (levée quasi totale des mesures), à quelle fréquence faites-vous du **télétravail** ? (Une seule réponse possible)

- ○ Pas de télétravail (1)
- ○ 1 jour/semaine (2)
- ○ 2 jours/semaine (3)
- ○ 3 jours/semaine (4)
- ○ 4 jours/semaine (5)
- ○ 5 jours/semaine (6)

Q15 Quel est le mode de transport principal (avec lequel vous effectuez la majeure partie du trajet) pour vous rendre sur votre lieu de travail ?

- ○ Voiture seul (1)
- ○ Voiture avec des membres de la famille (2)
- ○ Voiture avec d'autres travailleurs.euses (3)
- ○ Vélo non-électrique (4)
- ○ Vélo électrique (< 25km/h) (5)
- ○ Speed pedelec (6)
- ○ Train (7)
- ○ Bus TEC (8)
- ○ Transport collectif organisé par l'employeur (9)
- ○ Cyclomoteur ou moto (10)
- ○ À pied (11)
- ○ Engin de déplacement motorisé (trottinette, hoverboard, monowheel, Segway...) (12)
- ○ Engin de déplacement non motorisé (trottinette, rollers, skateboard...) (13)

Q16 **Avant** la pandémie de Covid-19, à quelle fréquence (du lundi au vendredi) utilisiez-vous ces modes de transports pour vous rendre au travail ?

	Tous les jours ou presque (12)	Au moins 2 déplacements par semaine (1)	Au moins 2 déplacements par mois (2)	Exceptionnellement (3)	Jamais (14)
Voiture seul (1)	○	○	○	○	○
Voiture avec des membres de la famille (2)	○	○	○	○	○
Voiture avec d'autres travailleurs.euses (3)	○	○	○	○	○
Vélo non-électrique (4)	○	○	○	○	○
Vélo électrique (13)	○	○	○	○	○
Train (14)	○	○	○	○	○
Transport collectif organisé par l'employeur (15)	○	○	○	○	○
Bus TEC (16)	○	○	○	○	○
Cyclomoteur ou moto (17)	○	○	○	○	○
À pied (18)	○	○	○	○	○
Engin de déplacement motorisé (trottinette, hoverboard.monowheel, segway...) (19)	○	○	○	○	○
Engin de déplacement non motorisé (trottinette, rollers, skateboard...) (20)	○	○	○	○	○

Q17 **Pendant** la période de confinement (interdiction partielle de déplacements) à quelle fréquence (du lundi au vendredi) utilisiez-vous ces modes de transports pour vous rendre au travail ?

	Tous les jours ou presque (12)	Au moins 2 déplacements par semaine (1)	Au moins 2 déplacements par mois (2)	Exceptionnellement (3)	Jamais (14)
Voiture seul (1)	○	○	○	○	○
Voiture avec des membres de la famille (2)	○	○	○	○	○
Voiture avec d'autres travailleurs.euses (3)	○	○	○	○	○
Vélo non-électrique (4)	○	○	○	○	○
Vélo électrique (13)	○	○	○	○	○
Train (14)	○	○	○	○	○
Transport collectif organisé par l'employeur (15)	○	○	○	○	○
Bus TEC (16)	○	○	○	○	○
Cyclomoteur ou moto (17)	○	○	○	○	○
À pied (18)	○	○	○	○	○
Engin de déplacement motorisé (trottinette, hoverboard.monowheel, segway...) (19)	○	○	○	○	○
Engin de déplacement non motorisé (trottinette, rollers, skateboard...) (20)	○	○	○	○	○

Q18 Depuis **la fin** (levée quasi totale des mesures) du confinement, à quelle fréquence (du lundi au vendredi) utilisez-vous ces modes de transports pour vous rendre au travail ?

	Tous les jours ou presque (12)	Au moins 2 déplacements par semaine (1)	Au moins 2 déplacements par mois (2)	Exceptionnellement (3)	Jamais (14)
Voiture seul (1)	○	○	○	○	○
Voiture avec des membres de la famille (2)	○	○	○	○	○
Voiture avec d'autres travailleurs.euses (3)	○	○	○	○	○
Vélo non-électrique (4)	○	○	○	○	○
Vélo électrique (13)	○	○	○	○	○
Train (14)	○	○	○	○	○
Transport collectif organisé par l'employeur (15)	○	○	○	○	○
Bus TEC (16)	○	○	○	○	○
Cyclomoteur ou moto (17)	○	○	○	○	○
À pied (18)	○	○	○	○	○
Engin de déplacement motorisé (trottinette, hoverboard.monowheel, segway...) (19)	○	○	○	○	○
Engin de déplacement non motorisé (trottinette, rollers, skateboard...) (20)	○	○	○	○	○

Q19 Utilisez-vous un autre moyen de transport (plus de 3 jours par mois) pour le trajet domicile-travail ?

○ Oui (1)

○ Non (2)

Q20 Si oui, cochez le mode de transport :

- ○ Voiture avec des membres de la famille (1)
- ○ Voiture avec d'autres travailleurs.euses (2)
- ○ Vélo non-électrique (3)
- ○ Vélo électrique (< 25km/h) (4)
- ○ Speed pedelec (5)
- ○ Train (6)
- ○ Bus TEC (7)
- ○ Transport collectif organisé par l'employeur (8)
- ○ Cyclomoteur ou moto (9)
- ○ À pied (10)
- ○ Engin de déplacement motorisé (trottinette, hoverboard, monowheel, Segway...) (11)
- ○ Engin de déplacement non motorisé (trottinette, rollers, skateboard...) (12)

Q21 Si vous utilisez majoritairement la voiture pour vous rendre sur votre lieu de travail rencontrez-vous des problèmes de stationnement ?

- ○ Oui (1)
- ○ Non, j'ai une place réservée (2)
- ○ Non, il y a une offre de stationnement importante à proximité (3)
- ○ Non, compte tenu de mes horaires (4)
- ○ Autre, Précisez... (5) _____

Q22 **Avant** la pandémie de Covid-19 à quelle fréquence utilisiez-vous votre mode de transport principal **en combinaison** avec les propositions suivantes afin de vous rendre sur votre lieu de travail ?

	Quotidiennement (12)	Une à quelques fois par mois (1)	Une à quelques fois par an (2)	Jamais ou moins d'une fois par an (3)
Voiture seul (1)	○	○	○	○
Voiture avec des membres de la famille (2)	○	○	○	○
Voiture avec d'autres travailleurs.euses (3)	○	○	○	○
Vélo non-électrique (4)	○	○	○	○
Vélo électrique (13)	○	○	○	○
Train (14)	○	○	○	○
Transport collectif organisé par l'employeur (15)	○	○	○	○
Bus TEC (16)	○	○	○	○
Cyclomoteur ou moto (17)	○	○	○	○
Engin de déplacement motorisé (trottinette, hoverboard.monowheel, segway...) (19)	○	○	○	○
Engin de déplacement non motorisé (trottinette, rollers, skateboard...) (20)	○	○	○	○

Q23 **Pendant** la période de confinement (interdiction partielle de déplacements) à quelle fréquence utilisiez-vous votre mode de transport principal **en combinaison** avec les propositions suivantes afin de vous rendre sur votre lieu de travail ?

	Quotidiennement (12)	Une à quelques fois par mois (1)	Une à quelques fois par an (2)	Jamais ou moins d'une fois par an (3)
Voiture seul (1)	○	○	○	○
Voiture avec des membres de la famille (2)	○	○	○	○
Voiture avec d'autres travailleurs.euses (3)	○	○	○	○
Vélo non-électrique (4)	○	○	○	○
Vélo électrique (13)	○	○	○	○
Train (14)	○	○	○	○
Transport collectif organisé par l'employeur (15)	○	○	○	○
Bus TEC (16)	○	○	○	○
Cyclomoteur ou moto (17)	○	○	○	○
Engin de déplacement motorisé (trottinette, hoverboard.monowheel, segway...) (19)	○	○	○	○
Engin de déplacement non motorisé (trottinette, rollers, skateboard...) (20)	○	○	○	○

Q24 Depuis **la fin** du confinement (levée quasi totale des mesures), à quelle fréquence utilisez-vous votre mode de transport principal **en combinaison** avec les propositions suivantes afin de vous rendre sur votre lieu de travail ?

	Quotidiennement (12)	Une à quelques fois par mois (1)	Une à quelques fois par an (2)	Jamais ou moins d'une fois par an (3)
Voiture seul (1)	○	○	○	○
Voiture avec des membres de la famille (2)	○	○	○	○
Voiture avec d'autres travailleurs.euses (3)	○	○	○	○
Vélo non-électrique (4)	○	○	○	○
Vélo électrique (13)	○	○	○	○
Train (14)	○	○	○	○
Transport collectif organisé par l'employeur (15)	○	○	○	○
Bus TEC (16)	○	○	○	○
Cyclomoteur ou moto (17)	○	○	○	○
Engin de déplacement motorisé (trottinette, hoverboard.monowheel, segway...) (19)	○	○	○	○
Engin de déplacement non motorisé (trottinette, rollers, skateboard...) (20)	○	○	○	○

Q25 Êtes-vous inscrit(e) sur une plateforme de covoiturage ou de voitures partagées (Cambio…)?

- ○ Oui (1)
- ○ Non (2)

Q26 Disposez-vous de stations de voitures partagées à proximité (moins de 3 km) de chez-vous ?

- ○ Oui (1)
- ○ Non (2)
- ○ Je ne sais pas (3)

Q27 Connaissez-vous le système de trottinettes électriques en libre-service ?

- ○ Oui (1)
- ○ Non (2)

Q28 **Avant** la pandémie de Covid-19 à quelle fréquence (du lundi au vendredi) utilisiez-vous **ces systèmes de transport partagés** afin de vous rendre sur votre lieu de travail ?

	Toujours (1)	Souvent (2)	Rarement (4)	Jamais (3)	Je préfère ne pas répondre (6)
Le vélo partagé (1)	○	○	○	○	○
Le covoiturage ou/et la voiture partagée (2)	○	○	○	○	○
Les trottinettes électriques en libre-service (3)	○	○	○	○	○

Q29 **Pendant** la période de confinement (interdiction partielle de déplacements) à quelle fréquence (du lundi au vendredi) utilisiez-vous **ces systèmes de transport partagés** afin de vous rendre sur votre lieu de travail ?

	Toujours (1)	Souvent (2)	Rarement (4)	Jamais (3)	Je préfère ne pas répondre (6)
Le vélo partagé (1)	○	○	○	○	○
Le covoiturage ou/et la voiture partagée (2)	○	○	○	○	○
Les trottinettes électriques en libre-service (3)	○	○	○	○	○

Q30 Depuis **la fin** du confinement (levée quasi totale des mesures), à quelle fréquence (du lundi au vendredi) utilisez-vous **ces systèmes de transport partagés** afin de vous rendre sur votre lieu de travail ?

	Toujours (1)	Souvent (2)	Rarement (4)	Jamais (3)	Je préfère ne pas répondre (6)
Le vélo partagé (1)	○	○	○	○	○
Le covoiturage ou/et la voiture partagée (2)	○	○	○	○	○
Les trottinettes électriques en libre-service (3)	○	○	○	○	○

Q31 Vous utilisez peu (au plus 1 fois semaine) ou pas **le vélo partagé** pour quelle raison ?

- [ ] Je dispose déjà d'un vélo personnel (1)
- [ ] Pas pratique et contraignant (2)
- [ ] Pas d'opportunité à proximité de mes lieux de départ ou d'arrivée (3)
- [ ] Les distances domicile-travail sont trop grandes (4)
- [ ] Pour cause de distanciation sociale (5)
- [ ] Réseau routier jugé inadapté et mauvaise qualité de la route (6)
- [ ] Manque de confiance dans le système (7)
- [ ] Autres (8) _____

Q32 Vous utilisez peu (au plus 1 fois semaine) ou pas **le covoiturage ou la voiture partagée** pour quelle raison ?

- [ ] Vous n'en voyez pas l'intérêt (vous n'avez pas de problème de mobilité) (1)
- [ ] Pas pratique et contraignant (2)
- [ ] Pas d'opportunité à proximité de mes lieux de départ ou d'arrivée (3)
- [ ] Pour cause de distanciation sociale (4)
- [ ] Votre zone est suffisamment desservie en transport en communs (5)
- [ ] Manque de confiance dans le système (6)
- [ ] Autres (7) _____

Q33 Vous utilisez peu (au plus 1 fois semaine) ou pas **les trottinettes électriques en libre-service** pour quelle raison ?

- [ ] Je dispose déjà d'une trottinette (1)
- [ ] Pas pratique et contraignant (2)
- [ ] Pas d'opportunité à proximité de mes lieux de départ ou d'arrivée (3)
- [ ] Les distances domicile-travail sont trop grandes (4)
- [ ] Pour cause de distanciation sociale (5)
- [ ] Réseau routier jugé inadapté et mauvaise qualité de la route (6)
- [ ] Manque de confiance dans le système (7)
- [ ] Vous trouvez cela dangereux (8)
- [ ] Autres (9) _____

Q34 Vous utilisez peu (au plus 1 fois semaine) ou pas **les transports en commun (train, bus…)** pour quelle raison:

- [ ] D'autres modes de transports suffisent à répondre à mes besoins de déplacements (1)
- [ ] Peu de besoins de me déplacer en général (2)
- [ ] Pour cause de distanciation sociale (3)
- [ ] Durée du trajet jugée trop longue (en raison de correspondances…) (4)
- [ ] Lieux de destinations et/ou domicile peu accessibles en transports en commun (5)
- [ ] Mode de transport jugé peu confortable (6)
- [ ] Horaires inadaptées à mes besoins de déplacements (7)

Autres (8) _____

Q35 Nous aimerions maintenant savoir quelle importance vous accordez à la proximité de certains services. Cochez la réponse vous correspondant.

	< d'1 km (1)	1-3 km (2)	3-5 km (6)	5-20 km (3)	>20 km (4)	Sans importance (5)
Hôpital et services d'urgence (1)	○	○	○	○	○	○
Pharmacie (2)	○	○	○	○	○	○
Petit commerce alimentaire (boulangerie, épicerie) (3)	○	○	○	○	○	○
Bibliothèque/ludothèque (4)	○	○	○	○	○	○
Restaurant/café (5)	○	○	○	○	○	○
Centre sportif ou de fitness/ piscine (6)	○	○	○	○	○	○
Gare ou arrêt de train (7)	○	○	○	○	○	○
Arrêt de bus/ Tram (8)	○	○	○	○	○	○
Ecole secondaire (9)	○	○	○	○	○	○
Bureau de poste (10)	○	○	○	○	○	○
Espaces verts publics (parcs,plaine de jeux...) (11)	○	○	○	○	○	○

Q36 Seriez-vous prêt à prendre les transports en commun plus souvent si les horaires des transports et le nombre de bus étaient adaptés à celle des horaires de travail ou scolaire afin de réduire le trafic des heures de pointes ?

- ○ Oui (1)
- ○ Non (2)
- ○ Pas besoin (lieu de travail et domicile à proximité suffisante) (3)

Q37 Aimeriez-vous en accord avec votre employeur pouvoir décaler vos horaires, cela dans l'objectif de réduire l'affluence dans les transports en communs aux heures de pointes ?

- ○ Oui (1)
- ○ Non (2)

Q38 Avez-vous fait l'acquisition d'une résidence ces dernières années se situant à plus de 50 km de votre lieu de travail ?

- ○ Oui (1)
- ○ Non (2)

Q39 Seriez-vous prêt à passer à une voiture électrique, hybride ou autonome si ce n'est déjà le cas ?

- ○ Oui (1)
- ○ Non (2)
- ○ Pas concerné(e) (3)

Q40 À quel genre vous identifiez-vous ?

- ○ Homme (1)
- ○ Femme (2)
- ○ Autre (3)
- ○ Je ne souhaite pas répondre à cette question (4)

Q41 Quel est votre âge ?

- ○ Indiquez ici (4) _____

Q42 Quel est le revenu net mensuel de votre ménage ? Pour ce faire, totalisez les revenus professionnels nets (c'est-à-dire ce que chaque personne de votre ménage reçoit effectivement

chaque mois) mais aussi les autres revenus comme les allocations familiales, les allocations de chômage, les aides sociales, les pensions, les primes, les revenus immobiliers, mobiliers, etc.

- ○ 0-400 € (1)
- ○ 500-999 € (2)
- ○ 1000-1499 € (3)
- ○ 1500-1999 € (4)
- ○ 2000-2499 € (5)
- ○ 2500-2999 € (6)
- ○ 3000-3499 € (7)
- ○ 3500-3999 € (8)
- ○ 4000-4499 € (9)
- ○ 4500-4999 € (10)
- ○ 5000-5249 € (11)
- ○ 5250 – 5999 € (12)
- ○ 6000 € ou plus (13)
- ○ Je préfère ne pas répondre (14)

Q43 Quel est le niveau d’étude maximum (le diplôme le plus élevé) que vous avez atteint à ce jour ?

- ○ Pas de diplôme (1)
- ○ Enseignement primaire (CEB) (2)
- ○ Enseignement secondaire général (Inférieure ou supérieure) (3)
- ○ Enseignement secondaire technique (Inférieure ou supérieure) (4)
- ○ Enseignement supérieur non universitaire de type court (2 à 3 ans, Bachelier professionnalisant, Graduat) (5)
- ○ Enseignement supérieur non universitaire de type long (4 à 5 ans, Master, Licence) (6)
- ○ Enseignement supérieur universitaire (4 à 5 ans, Master, Licence, Docteur en médecine) (7)

Doctorat avec thèse (8)

Executive summary

COVID-19 has unexpectedly changed the way we move around our cities. As urban transportation remains an essential service, governments, agencies, and organizations are challenged to develop and implement changes that address changing travel demand, shifting travel patterns, and promoting physical/social distance to limit the spread of the virus. The public's travel behaviors have also changed during this period, favoring more physically distant options such as biking, carpooling, and other new mobility alternatives, and driving when available, over public transportation options. What lessons can cities learn from the various response measures taken during this crisis, and how do current changes in urban transportation needs inform future urban transportation planning, favoring more space and potentially moving toward more sustainable and active modes of transportation. This study highlights the different holistic approaches and generates a toolkit of interventions for the urban transport sector. Several cities have implemented measures such as mandatory masking and temperature monitoring on public transport, promoting and facilitating access to bike sharing and other new mobility programs, adapting and reallocating space on public roads to cyclists and pedestrians to promote physical distance, among others. Although designed as initial emergency responses, the measures in this toolkit can be developed into long-term programs to change attitudes toward urban transportation, encourage alternative or more active modes of travel, and reallocate public space to people.

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